
Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina

Volume I: Guidance Policy Report

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EXECUTIVE SUMMARY

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The North Carolina Department of Transportation (NCDOT), in consultation with the North Carolina Department of Environment and Natural Resources (NCDENR), undertook to develop a guidance document, or policy, for evaluating the indirect and cumulative effects of transportation projects in January 1999. The assessment of indirect and cumulative effects is identified as a requirement under the National Environmental Policy Act of 1969, as amended (NEPA), the North Carolina Environmental Policy Act (SEPA), and under the Council on Environmental Quality (CEQ) regulations implementing NEPA. However, there are limited standardized and comprehensive rules, legislation, procedures or guidance available for implementing these requirements. Compounding this shortcoming is the apparent confusion regarding basic definitions and terms, such as the extent of corporal and temporal boundaries in determining these effects. These problems have hindered the assessment of indirect and cumulative effects in environmental impact statements throughout the country.

The purpose of this guidance is to provide NCDOT NEPA/SEPA practitioners with a tool to help in the identification, analysis and assessment of indirect and cumulative effects of transportation projects as part of the NEPA/SEPA assessment process. This guidance is also intended to help federal and state environmental regulatory and resource agencies, such as NCDENR, to understand the assessment of indirect and cumulative effects and to provide a “standard” for reviewing NEPA/SEPA assessment documents. Specifically, this guidance is intended to meet the following objectives:

- < Describe the terminology related specifically to indirect and cumulative effects assessment as defined by regulations and clarified by the courts.
- < Apply the existing case law regarding indirect and cumulative effects assessment to interpretations of terms and applicable practices under NEPA/SEPA.
- < Provide direction on project scoping issues and their implications for addressing indirect and cumulative effects.
- < Provide direction on identification and evaluation of project-induced growth effects.
- < Describe various methodologies and techniques, which may be considered when undertaking indirect and cumulative effects assessment.
- < Describe a framework for incorporating in indirect and cumulative effects in NEPA/SEPA documents, e.g., environmental assessments or environmental impact statements, as well as in the planning and other activities, which precede the documents.

This volume, Volume I: Guidance Policy Report, comprises the technical, memoranda prepared for the agencies’ review in developing the guidance. Volume II: Practitioner’s Handbook, describes the “how-to” methods of indirect/cumulative impact assessment.

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**I. BACKGROUND ON REQUIREMENTS FOR ASSESSING
INDIRECT AND CUMULATIVE PROJECT IMPACTS**

SECTION I

BACKGROUND ON REQUIREMENTS FOR ASSESSING INDIRECT AND CUMULATIVE PROJECT IMPACTS

1.0 INTRODUCTION

Assessment of indirect and cumulative effects is identified as a requirement under the National Environmental Policy Act of 1969, as amended (NEPA), and under the Council on Environmental Quality (CEQ) regulations implementing NEPA. Currently, however, there are limited standardized and comprehensive rules, legislation, procedures or guidance available for implementing this requirement. Compounding this shortcoming is the apparent confusion regarding basic definitions and terms, and in the extent of corporal and temporal boundaries, affecting the understanding of indirect and cumulative effects. These problems have hindered the assessment of indirect and cumulative effects in Environmental Impact Statement (EIS) and related documents throughout the country, as well as in North Carolina. Under the North Carolina State Environmental Policy Act of 1976 (SEPA) the State has generally adopted the federal definitions of indirect and cumulative effects.

2.0 OBJECTIVE

The objective of this section is to provide relevant regulatory and legal definitions and interpretations of what constitutes indirect and cumulative effects under NEPA and SEPA. Review of these definitions and interpretations provides a common level of understanding of the fundamentals of indirect and cumulative impact assessment. Full understanding of these fundamentals serves to minimize misunderstandings and, thereby, aid parties in reaching consensus on indirect and cumulative impact assessment.

3.0 RELEVANT STATUTES, REGULATIONS AND GUIDELINES

3.1 Federal

3.1.1 National Environmental Policy Act (NEPA)

The Federal statute most relevant to the assessment of indirect effects is the National Environmental Policy Act (NEPA) of 1969, as amended. While NEPA does not specifically refer to indirect effects, it contains two sections that are related to indirect effects as a concern for Federal projects. First, in Section 101(b), NEPA makes it the responsibility of the Federal Government to:

“ . . . assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings . . . attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and

unintended consequences . . . [and] preserve important historic, cultural, and natural aspects of our national heritage . . .” (NEPA 1969, 42 USC 4331 Section 101(b))

In addition, it states that:

“ . . . the Federal Government shall include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on the environmental impact of the proposed action [and] any adverse environmental effects which cannot be avoided should the proposal be implemented.” (NEPA 1969, 42 USC 4332 Section 102(c))

The meaning of these sections was clarified when the CEQ issued its NEPA regulation in 1978, as part of its mission to provide assistance to Federal agencies on implementing NEPA. In the terminology section of the regulation, the CEQ provides definitions of “*effects*.” Specifically, effects are defined as having two components: direct and indirect. Direct effects “*. . . are caused by the action and occur at the same time and place,*” and indirect effects “*. . . are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable*” (CEQ 1986, 40 CFR 1508.8). The CEQ regulation adds that indirect effects “*. . . may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.*” The CEQ differentiates direct and indirect effects from the term “*cumulative impact,*” which “*. . . is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions . . .*”

3.1.2 Agency Documents

The CEQ noted that the terminology of 40 CFR 1508.1 should be uniform throughout the Federal Government. Uniformity is reflected in the NEPA-implementing regulations of the various Federal agencies, including those agencies of the U.S. DOT (i.e., United States Coast Guard [USCG], Federal Aviation Administration (FAA), Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), Federal Transit Administration (FTA), St. Lawrence Seaway Development Corporation, and Maritime Administration). For example, the FHWA and the FTA reference the CEQ regulation for definitions in their NEPA-implementing regulation -- 23 CFR 771, Environmental Impact and Related Procedures. On the other hand, a review of agency manuals, handbooks, policy papers, position papers, and other documents that do not have the force of regulation reveals a variety of terminologies.

Many of the agencies under the direction of the U.S. DOT have established their own guidelines for the implementation of the CEQ Regulations. The U.S. DOT defines the term “*secondary effects*” as “*those effects which can foreseeably occur due to the proposed action,*” such as activities which “*induce new facilities and activities*” (CEQ 1986, 1510.1C, p. 232). The U.S. DOT refers directly to the CEQ guidelines for the definition of “*indirect effects,*” but refers to them as “*secondary or other foreseeable effects.*”

In its *Environmental Policy Statement*, the FHWA uses “*indirect effects*” as an overarching term, covering both secondary and cumulative effects. This document uses the term “*secondary effects*” as “*social, economic, and environmental impacts which can appear in the future*” (FHWA 1992). Another FHWA paper also uses the term “*secondary effects*.” The paper cites FHWA Technical Advisory 6640.8A on the types of secondary impacts that should be discussed in the preparation of documents. “*These areas generally involve resources that exhibit induced changes from project activities . . . things like the social and economic structure of a community, floodplains, and areawide water quality*” (FHWA 1992, p. 2).

In a project planning document, the FTA differentiates indirect and direct effects, but does not actually define either of them. They are simply cited as two different aspects of several categories of effects, including economic, social, and environmental (UMTA 1986). A second source from the FTA uses the term “*secondary development*,” which it states “. . . can be thought of as changes in land use that could be fostered indirectly by the implementation of a mass transportation project on properties adjacent to or near it” (UMTA 1979).

A sampling of various other Federal agencies’ documents also reveals a variety of terminology. The focus here is on definitions used by several agencies with whom U.S. DOT agencies often coordinate on NEPA document preparation or in satisfying other requirements. In its handbook on NEPA, the U.S. Fish and Wildlife Service defines the term “*secondary effects*” as those which are beyond the immediate effect on the environment of a project, or those which consist of the ultimate changes in the environment (USFWS 1983). The USFWS definition of the term “*secondary effects*” appears to be consistent with the CEQ definition of indirect effects, in that both encompass the concept of “*removed in time and distance*.” The Advisory Council on Historic Preservation uses the term “*indirect impact*,” but defines it only by differentiating it from direct impacts without specificity (NHPA undated document, Appendix).

In its *Guidelines for Specification of Disposal Sites for Dredged or Fill Material*, the U.S. EPA uses the term “*secondary effects*” as “. . . effects on an aquatic ecosystem that are associated with a discharge of dredged or fill material, but do not result from the actual placement of the dredged or fill material.” It should be noted that these guidelines implement Section 404(b)(1) of the Clean Water Act, not NEPA. In other words, their terminology is not required to be consistent with the CEQ terminology. While both the CEQ’s “*indirect effects*” and the U.S. EPA Section 404(b)(1) guidelines’ “*secondary effects*” are caused by the action and are removed from the direct effect, the latter term does not include the concept of “*reasonably foreseeable*.”

This summary of definitions of indirect effects and other terms indicates that a variety of terms are in use by Federal agencies -- in particular, “*indirect*,” “*induced*,” and “*secondary*” -- despite a uniform regulatory definition. In some cases, these terms are used to convey the same or similar meaning. In other cases, the terms are used to convey different meanings.

The FAA’s guidelines on the economic effects of airports (USDOT/FAA 1992, p. 19) delineate specific steps to determine the indirect aspects of these economic effects. The guidelines suggest concentrating on the economic activities which would not have occurred in the absence of the airport. One way to achieve this is to distinguish between persons who would not have traveled to the region if there were no airport and those who would have come to the area anyway by some other means. The former should be used to determine indirect effects. After estimating the number

of visitors via the airport, the guidelines describe how it is possible to use a table of value-added expenditures per visitor to arrive at an approximation of the indirect economic impacts to the region. The guidelines do caution that it is often difficult to distinguish between those who come to the region simply due to the airport and those who would come to the region anyway by other means. This can result in an exaggeration of indirect economic effects credited to the airport.

The FTA also provides a step-by-step approach for assessing indirect effects, although it is much more general than that of the FAA (UMTA 1979). The FTA prescribes the following steps:

- 1) Work with local planning boards, which may have a more accurate view of types of potential indirect effects than an outside observer (e.g., a Federal agency);
- 2) Conduct a survey of potentially affected areas;
- 3) Compile a list of potentially affected development projects;
- 4) Compare the probable course of development to local zoning restrictions; and
- 5) Compile a list of probable indirect impacts, including the extent of these impacts in relation to the characteristics compiled in earlier steps.

A guide to the significance of potential indirect impacts is then provided, using several examples.

One noteworthy aspect of the FTA procedure is that the significance of impacts is positively correlated with the degree to which an impact is viewed as negative. In other words, the more negative the effect, the more significant the effect is deemed to be. According to this logic, even an indirect impact which affected a huge area would not be called significant if it were deemed acceptable by the local community. Obviously, if any of the secondary development would potentially impact sensitive resources, e.g., wetlands or critical endangered species habitat, the indirect effect could be considered significant regardless of size. Furthermore, the CEQ regulation notes that impacts may be both beneficial and adverse.

The FHWA's position paper on secondary impact assessment (FHWA 1992) takes a more philosophical approach to indirect impact assessment. The paper highlights several ways of approaching indirect effects:

- 1) Consider indirect impacts as early in the EIS process as possible;
- 2) Think about resources as part of an integrated system, such that a change to any one part will affect all others;
- 3) Cooperate with local planning boards and building inspection agencies who may have a more accurate sense of the potential indirect effects than a Federal agency;
- 4) Establish parameters for both the area affected and the time for which indirect impacts can be acceptably traced back to the original project (without these parameters, an accurate accounting of indirect effects is difficult to achieve);
- 5) Assess the potential indirect impacts, paying particular attention to the public service and natural resource base; and
- 6) Consider mitigation measures, although mitigation of indirect effects is trying because of the cost and the difficulty in planning for uncertain events.

A second FHWA document refers to the assessment of indirect impacts in the context of direct impacts, but does not discuss assessment techniques specific to either (FHWA 1987). However, the document is noteworthy because of the manner in which indirect effects are organized. While most of the guidelines reviewed here contain separate sections on indirect effects, this document includes indirect effects under the headings of each of the traditional impact categories (e.g., social, environmental, economic). This treatment of indirect effects makes it clear that they are part of all aspects of an EIS or an environmental assessment (EA), something that is not altogether clear in many documents that classify indirect effects separately.

3.2 North Carolina Rules and Regulations

3.2.1 North Carolina State Environmental Policy Act (SEPA)

The North Carolina statute most relevant to the assessment of indirect and cumulative effects is the North Carolina State Environmental Policy Act (SEPA) of 1976 (G.S.113A), as amended. SEPA specifically refers to indirect and cumulative impacts under its General Provisions (1 NCAC 25.0108) published in the North Carolina Administrative Code (NCAC):

“. . . This Chapter is applicable to any situation where there is: . . . (3) a potential environmental effect upon either natural resources, public health and safety, natural beauty, or historical or cultural elements of the state’s common inheritance . . . , with environmental effect defined as . . . “Environmental effect” includes direct, indirect, and cumulative impacts for the project or program that may be significant, depending upon the manner in which the activity is carried out”

1 NCAC 25, however, does not define direct, indirect or cumulative impacts, or suggest how they should be addressed. The NCAC focuses mostly on procedures and format including documentation format/requirements under .0500 for a state Environmental Assessment (EA), and under .0600 for a state Environmental Impact Assessment (EIS). Under the content requirement for an EA (1 NCAC 25.0502), the act states that *“. . . the EA shall include maps and a brief discussion of . . . (4) environmental effects of the proposed activity”* For the Format and Content requirements for a state EIS (1 NCAC 25.0603), the NCAC specifically mentions including assessments of indirect (1 NCAC 25.0603(6)(b)) and cumulative (1 NCAC 25.0603(6)(c)) effects and their significance as part of the scientific and analytical comparisons of the alternatives under Environmental Consequences.

NCAC also addresses the issue of an environmental document prepared under NEPA. In 1 NCAC 25.0402 it states:

“. . . If an environmental document is prepared under the provisions of the national Environmental Policy Act (NEPA) for a specific activity, and it that document is reviewed through the Clearinghouse process, then this review shall constitute compliance with the requirements of this Chapter for that activity”

In other words, NEPA documents must be submitted through the State Clearinghouse for state agency review to meet SEPA requirements. By reference then this includes indirect and cumulative effects as defined under NEPA.

3.2.2 Department of Environment & Natural Resources (NCDENR)

As the environmental agency with review, compliance and enforcement authority in North Carolina, the Department of Environment, & Natural Resources (DENR) has incorporated compliance with SEPA (1 NCAC 25) by reference (15A NCAC 1C). Under 15A NCAC 1C.0101(c), the code specifically states:

“ . . . The provisions of the rules in this subchapter, the state rules (1 NCAC 25), and the SEPA shall be read together as a whole in order to comply with the spirit and letter of the law . . . ”

and later under Agency Compliance (15A NCAC 1C.0102):

“ . . . (a) Each EHNHR agency shall interpret the provisions of the SEPA as a supplement to its existing authority and as a mandate to view its policies and programs in the light of the SEPA’s comprehensive environmental objectives, except where existing law applicable to the agency’s operations expressly prohibits compliance or makes compliance impossible.

“ . . . (b) As part of making a decision on a project for which an environmental document has been prepared, the agency decision-maker shall review the document and incorporate it as part of continuing deliberations. The resulting decision shall be made after weighing all the impacts and mitigation measures presented in the environmental document, which will become part of the decision making record . . . ”

By reference, these regulations also establish that the minimum criteria in rule 15A NCDC 1C.0504 be used in determining when environmental documents are not required. These regulations operate by allowing separation of activities into “major” and “minor” depending upon the potential for environmental effects. Some exceptions to the minimum criteria are also provided for under 1 NCAC 1C.0503.

3.2.2.1 Indirect and Cumulative Effects

15A NCAC 1C also specifically defines “Cumulative Effect” and “Indirect Effects” for application to DENR administered regulations. These are defined as “ . . . (2) “Cumulative Effect” results from the incremental impact of the proposed activity when added to other past, present, and reasonably foreseeable activities regardless of what entities undertake such other activities. Cumulative effects can result from individually minor but collectively significant activities taking place over a period of time . . . ”. Indirect Effects are defined as: “ . . . (4) “Indirect Effects” are caused by and result from the proposed activity although they are later in time or further removed in distance, but they are still reasonably foreseeable . . . ”

3.2.2.2 Department of Transportation

Pursuant to 1NCAC 25.401(a), the Secretary of Administration approved the minimum criteria for state-funded highway projects on August 28, 1992. The criteria include reference to “secondary impacts,” and “cumulative effects” stating that an activity normally falling below the minimum criteria for evaluation may require an environmental document if “[t]he proposed activity has secondary impacts, or is part of cumulative effects, not generally covered in the approval process for the state action, and that may result in a potential risk to human health or the environment.” The document defines “non-major actions” as “actions which do not individually or cumulatively have a significant effect on the human environment.” Actions meeting the definition of “major actions” include those that are “likely to precipitate significant foreseeable alterations in land use; planned growth; development patterns; traffic volumes; travel patterns; [and] transportation services...”

3.2.2.3 Coastal Area Management Act (CAMA)

The Coastal Area Management Act (CAMA) applies specifically to the twenty coastal counties in North Carolina. CAMA is a major vehicle for environmental management and protection of unique and sensitive coastal habitats in North Carolina and is applied primarily as a planning and permitting tool. Implementation of CAMA must conform to SEPA and NCDEHNR regulations regarding consideration of indirect and cumulative effects. CAMA defines cumulative effects as:

...impacts attributable to the collective effects of a number of projects and include the effects of additional projects similar to the requested permit in areas available for development in the vicinity. (NCGS 113A-120 (a) (10))

Although indirect and cumulative effects are not specifically addressed in the CAMA regulations, these types of effects are implied—for example, under 15 NCAC 7H .0208(b)(1) spoil material must be “*stabilized to prevent entry of sediments into the adjacent water bodies or marsh*” and spoil material must pose “*no significant, long term wetland impacts*”—indirect effects removed from project site by distance and time.

3.2.2.4 Clean Water Act (CWA)

The Clean Water Act (CWA) refers to cumulative effects in standards for issuance of permits by the North Carolina Environmental Management Commission. The Act states that the Commission must “*act on permits so as to prevent violation of water quality standards due to the cumulative effects of permit decisions.*” (NCGS 143-215.1(b)(2)) The definition of cumulative effects under the CWA is identical to that for CAMA.

3.2.3 Other Regulations

Other regulations in North Carolina, including those dealing with air quality, the disposal of hazardous materials, and the application of fertilizers and pesticides, address issues related to indirect and cumulative effects, but do not explicitly refer to these types of effects.

4.0 CASE LAW

4.1 Introduction

To date, there are no published decisions by North Carolina state courts evaluating the cumulative or indirect effects of state projects or actions of any type, including transportation projects. Most North Carolina transportation proposals, however, are subject to the requirements of the National Environmental Policy Act (“NEPA”). NEPA requires preparation of an Environmental Impact Statement (“EIS”) for all major federal actions “significantly affecting the quality of the human environment.” 42 U.S.C. § 4332 (2)(C)(I). The Council on Environmental Quality (“CEQ”) has promulgated regulations which implement NEPA, guide the EIS process and define “federal actions” as those which are subject to federal control and responsibility, including “projects and programs entirely or partly financed, assisted, conducted, regulated, or approved by federal agencies.” 40 C.F.R. § 1508.18(a). The vast majority of North Carolina state transportation projects involve federal funding or financial assistance, are subject to federal regulation or permitting, are often planned and implemented with the direct involvement of the Federal Highway Administration (“FHWA”) and are thus federal actions subject to NEPA. Accordingly, federal case law provides guidance to North Carolina transportation planners and decision makers involved in identifying and evaluating the indirect and cumulative effects of transportation projects and proposals.

There is a small but growing body of federal case law regarding the cumulative and indirect effects of transportation projects and other proposed actions that establishes the legal standards federal courts apply when reviewing the adequacy of indirect impact analysis in EISs, Environmental Assessments (“EAs”) and other documents required by the NEPA. This section will review these standards – as developed through major federal district, appeals and Supreme Court opinions – and the legal framework and guidance they provide for state agencies engaged in the process of identifying and assessing the indirect effects of transportation proposals. Particular attention will be given to the very small number of federal cases reviewing North Carolina transportation projects involving indirect or cumulative effect analysis. Arguments in law review articles and environmental law treatises are also occasionally referenced when they help explicate federal courts’ analysis of the environmental impacts of agency actions. Although comprehensive, this case law review is not intended to be an exhaustive canvass or definitive examination of the current status of federal court review of EIS preparation.

This section will review : 1) threshold questions in EIS preparation, including: a) analysis of what constitutes “significant” impacts; b) when significant impacts are “reasonably foreseeable;” c) the timing and scope of an EIS, including segmentation and the impacts of cumulative actions; and d) the legal standard courts apply to review an agency finding of no significant impact (“FONSI”) in an EA, resulting in a decision not to prepare an EIS; 2) the adequacy of cumulative and indirect effect evaluation in an EIS, including: a) the judicial standard of review federal courts apply when evaluating the content of an EIS; b) analysis of general principles and emerging trends in transportation cases involving induced-growth and other indirect impacts; and c) environmental justice issues; 3) other legal standards often at issue in cumulative and indirect effects cases, including a) the “federalization” of non-federal transportation projects and the “small handles” problem and b) the statute of limitations on challenges to an EIS.

4.2 Threshold Legal Questions for EIS Preparation

NEPA requires preparation of an EIS for all major federal actions “significantly affecting the quality of the human environment.” 42 U.S.C. § 4332 (2)(C)(I). The EIS requirement is the primary mechanism to satisfy NEPA’s “twin aims”: 1) to ensure that the agency’s decision will be informed by detailed analysis of the significant environmental impacts of a proposal; and 2) to guarantee that this information will be available to the public, whose concerns and insight may then be incorporated into the decision through the comment process. *Robertson v. Methow Valley Citizen’s Council*, 490 U.S. 332, 109 S.Ct. 1835, 1845 (1989); *Morongo Band of Indians v. Federal Aviation Admin.*, 161 F.3d 569, 575 (9th Cir. 1998). The EIS must consider not only the direct effects of a proposed project, but the indirect and cumulative impacts as well, as long as they are significant. Although NEPA requires that agencies take a “hard look” at all significant environmental impacts, the statute’s twin aims mandate a procedural process, not a substantive result. *Robertson*, 109 S.Ct. at 1845. Agencies are required to analyze all reasonably foreseeable, significant impacts, but need not place concerns over these environmental effects above the goals and positive economic development, access, safety or other benefits of the proposed transportation project. “If the adverse environmental effects of the project are adequately identified and evaluated, the agency is not constrained by NEPA from deciding that other values outweigh the environmental costs.” *Id.* In large measure, then, NEPA “guards the environment through discussion and disclosure.” *Carmel-By-the-Sea v. U.S. Dept. of Transp.*, 123 F.3d 1142, 1150 (9th Cir. 1997).

4.2.1 General Legal Standards for Judicial Review of Environmental Impacts

As noted in the introduction, the Council on Environmental Quality (“CEQ”) has promulgated regulations which implement NEPA and guide the EIS process. See 40 C.F.R. §§ 1500-1508. The CEQ regulations define “major” and “federal” actions and provide guidance for establishing the scope of actions, project alternatives¹ and types of impacts to be considered in an EIS. NEPA requires that the significant direct, indirect and cumulative environmental impacts of a proposed project be analyzed. The CEQ regulations define direct impacts as those that are “caused by the action and occur at the same time and place.” 40 C.F.R. § 1508.8(a). Cumulative effects are defined as:

the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

40 C.F.R. § 1508.7. Indirect effects are those:

caused by the action [which] are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects

¹ There is a large body of federal case law related to the NEPA requirement that feasible alternatives “reasonably related” to the purposes of the proposed transportation project, including build and no-build alternatives, must be evaluated in an EIS. *Laguna Greenbelt, Inc. v. U.S. Dept. of Transp.*, 42 F.3d 517, 524-25 (9th Cir. 1994). As with the evaluation of impacts, “[a]n EIS need not consider every conceivable alternative, however, nor remote and speculative alternatives whose effects cannot be readily ascertained.” *Id.* at 525. Further discussion of project alternatives is beyond the scope of this study.

related to induced changes in the pattern of land use, population density or growth rate, and related effects in air and water and other natural systems, including ecosystems.

40 C.F.R. § 1508.8(b). The terms “indirect effects,” “secondary impacts,” “growth-inducing effects” and their variations are used interchangeably in federal case law, but all with the same meaning ascribed to “indirect effects” in the CEQ regulations. “The agency need not speculate about all conceivable impacts, but it must evaluate the reasonably foreseeable significant effects of the proposed action.” *Dubois v. U.S. Department of Agriculture*, 102 F.3d 1273, 1286 (1st Cir. 1996).

4.2.2 Significant Impacts

The CEQ regulations provide guidance for determining which environmental impacts “significantly” affect the environment:

“Significantly” as used in NEPA requires considerations of both context and intensity:

- a) Context...means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests and locally. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.
- b) Intensity...refers to the severity of the impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action.

40 C.F.R. § 1508.27. The regulations then describe ten (10) factors that should be considered in evaluating intensity, including the degree to which the proposed action: affects public health or safety, may affect sites, districts or objects listed on the National Register of Historic Places, may adversely affect federally listed endangered or threatened species, and the degree to which the effects on the quality of the human environment are likely to be highly controversial. *Id.* at § 1508.27 (a), (b), (d), (h), (I). The CEQ regulations are, by their terms, binding on federal agencies (40 C.F.R. § 1500.3) and the Supreme Court has held that the regulations are entitled to “substantial deference.” *Robertson*, 490 U.S. at 355, 109 S.Ct. at 1848, citing *Andrus v. Sierra Club*, 442 U.S. 347, 358 (1979). Among the CEQ regulation factors to be considered in evaluating significance are: “the degree to which the proposed action affects public health or safety; the unique geographical characteristics of the surrounding area; the potential for controversy; the possibility of unknown risks; and the potential effect on endangered species.” *Foundation on Economic Trends v. Weinberger*, 610 F.Supp. 829, 837-38 (D.D.C. 1985).

While direct, indirect and cumulative effects must all be evaluated for environmental impact, the focus of the inquiry should be on the significance of any impacts, regardless of type, rather than on classification of and differentiation between primary, secondary or cumulative impacts. *City of Davis v. Coleman*, 521 F.2d 661, 680-81 (9th Cir. 1975). The Coleman court noted that “so-called ‘secondary’ impacts are often as significant as ‘primary’ effects.” *Id.* at 676. In *Hanly v. Mitchell*, 460 F.2d 640, 647 (2nd Cir. 1972), the court developed a two part test for determining the significance of indirect effects involving: 1) the degree of change from current land use; and 2) the absolute, qualitative adverse environmental impacts of the project.

4.2.3 Reasonably Foreseeable Impacts

An EIS need not contemplate and evaluate every conceivable indirect or cumulative impact of a proposed agency action, only those that are “reasonably foreseeable.” In an early, landmark NEPA case, the Court of Appeals for the District of Columbia acknowledged that uncertainty is inherent in determining what environmental impacts are “reasonably foreseeable” but emphasized that uncertainty alone does not excuse an agency’s failure to evaluate all potentially significant future impacts:

[O]ne of the functions of a NEPA statement is to indicate the extent to which environmental effects are essentially unknown. It must be remembered that the basic thrust of an agency’s responsibilities under NEPA is to predict the environmental effects of the proposed action before the action is taken and those effects are fully known. Reasonable forecasting and speculation is thus implicit in NEPA, and we must reject any attempt by agencies to shirk their responsibilities under NEPA by labeling any and all discussion future environmental effects as “crystal ball inquiry.”

Scientists’ Inst. for Public Information, Inc. v. Atomic Energy Comm’n, 481 F.2d 1079, 1092 (D.C. Cir. 1973). The “crystal ball inquiry” and “reasonable forecasting” language of this case is routinely cited in indirect and cumulative effect cases; agencies may not dodge the required evaluation of reasonably foreseeable future impacts by labeling such attempts mere conjecture. However, the assertion in *Scientists’ Inst.* that “speculation is...implicit” in the assessment of reasonably foreseeable future impacts is rarely quoted. More recent cases reserve use the term “speculation” to distinguish between required “reasonable forecasting” and unreasonable contemplation of “highly speculative” future impacts. One year after *Scientists’ Inst.*, the Court of Appeals for the Ninth Circuit advanced a more circumscribed interpretation of what indirect effects must be evaluated in an EIS in *Trout Unlimited v. Morton*, 509 F.2d 509 F.2d 1276 (9th Cir. 1974). *Trout Unlimited* involved a challenge to an EIS for failure to analyze several possible environmental consequences that could conceivably result from further development of the Teton dam and reservoir. The court stated that:

Many of the consequences while possible are improbable. An EIS need not discuss remote or highly speculative consequences...A reasonably thorough discussion of the significant aspects of the probable environmental consequences is all that is required by an EIS.

Id. at 1283. Subsequent cases continue to distinguish “highly speculative” effects and improbable, remote consequences, which need not be evaluated, from impacts which are more realistically “probable” and “reasonably foreseeable.” See *Environmental Defense Fund, Inc. v. Hoffman*, 566 F.2d 1060 (8th Cir. 1977). After reiterating that “an agency need not speculate about all conceivable impacts,” but only reasonably foreseeable effects, the First Circuit further clarified that reasonable foreseeability means that “the impact is sufficiently likely to occur that a person of ordinary prudence would take it into account in reaching a decision.” *Sierra Club v. Marsh*, 976 F.2d 763, 767 (1st Cir. 1992) (*Sierra Club IV*). More recently, the First Circuit noted that:

An environmental impact would be considered “too speculative” for inclusion in an EIS if it cannot be described at the time the EIS is drafted with sufficient specificity to make its consideration useful to a reasonable decision-maker.

Dubois, 102 F.3d at 1286.

In an effort to relate typical factual issues to the general legal standard of “reasonably foreseeable” as developed in federal case law,² the CEQ provided agencies with the following detailed guidance for distinguishing between uncertain but probable effects and those that are too speculative and improbable:

[I]f there is total uncertainty about the future land owners or the nature of future land uses, then, of course, the agency is not required to engage in speculation or contemplation about their future plans. But, in the ordinary course of business, people do make judgments based upon reasonably foreseeable occurrences. It will often be possible to consider the likely purchasers and the development trends in that area or similar areas in recent years; or the likelihood that the land will be used for an energy project, shopping center, subdivision, farm or factory. The agency has the responsibility to make an informed judgment, and to estimate future impacts on that basis, especially if trends are ascertainable or potential purchasers have made themselves known. The agency cannot ignore uncertain, but probable, effects of its decisions.

Forty Most Asked Questions Concerning CEQ’s NEPA Regulations, 46 Federal Register (1981) at 18031 (answering the question “[h]ow should uncertainties about indirect effects of a proposal be addressed...?”) It should be noted, however, that CEQ’s Forty Questions is an “informal document” which is not a controlling authority, unlike the CEQ regulations themselves which are binding on federal agencies and given “substantial deference” by federal courts. *Northern Crawfish v. Federal Highway Admin.*, 858 F. Supp. 1503, 1527, n.12 (D. Kan. 1994).

As a general matter, significant impacts are reasonably foreseeable if they are not too speculative or improbable. An EA or EIS will not violate NEPA so long as an agency acknowledges and evaluates all potential impacts that are significant and are likely enough to be identified and “described with sufficient specificity” – either by the agency itself or by challengers during the comment process.

4.2.4 Timing and Scope of an EIS

4.2.4.1 Timing: EIS Need Only be Prepared for Actual Agency Proposals

In *Kleppe v. Sierra Club*, 427 U.S. 390 (1976), the Supreme Court limited the need to prepare an EIS only to those contemplated agency actions which had reached the formative stage of being definitive or concrete proposals, evidenced by a formal report (as opposed to conceptual or exploratory plans or ideas). While this “proposal” standard at first blush appeared to be a relatively bright-line, mechanistic rule, subsequent cases demonstrated that it is not always clear when a definitive proposal exists. The current CEQ regulations, which largely codify standards developed in previous federal case law, attempt to define and clarify this standard:

² The CEQ regulations were originally promulgated in 1973 to implement NEPA. As they have been subsequently amended and new sections promulgated, much of the CEQ regulations have attempted to generally codify federal case law relating to NEPA’s requirements. See Thatcher, *Understanding Interdependence in the Natural Environment: Some Thoughts on Cumulative Impact Assessment Under NEPA*, 20 Env’tl. L. 611, 613 (1990).

A “proposal” exists at that stage in the development of an action when an agency...has a goal and is actively preparing to make a decision on one or more alternative means of accomplishing that goal and the effects can be meaningfully evaluated...A proposal may exist in fact as well as by agency declaration that one exists.

40 C.F.R. § 1508.23.³

4.2.4.2 Scope, Segmentation and Impacts of Cumulative Actions

Agencies may not attempt to avoid NEPA’s requirements by dividing transportation projects into several smaller actions or component parts, each of which, considered separately, may not have significant environmental impacts. Accordingly, projects must not be segmented into smaller parts for which an EIS is not required when considered in isolation but which, if evaluated together, have substantial impacts. *Morongo*, 161 F.3d at 579.

FHWA regulations state that in order to ensure “meaningful evaluation of alternatives” the actions must 1) connect logical termini of sufficient length to address environmental matters on a broad scope; 2) have independent utility and significance; 3) nor restrict consideration of alternatives for other reasonably foreseeable improvements (23 CFR 771.111 (f)).

In addition to the scope of the transportation improvement that is evaluated, it is also important to consider the scope of effects analyzed in an EIS. “Although agencies are given ‘considerable discretion’ in defining the scope of an EIS, connected actions must be considered together.” *Morongo*, 161 F.3d at 579. Under the CEQ regulations, connected actions include those which: 1) automatically trigger other actions for which an EIS may be required; 2) cannot or will not proceed unless other actions are taken previously or simultaneously; and, 3) are interdependent parts of a larger action and depend upon that larger action for their justification. 40 C.F.R. § 1508.25(a) (I) -(iii). See *Alpine Lakes Protection Soc. v. U.S. Forest Serv.*, 838 F. Supp. 478 (W.D. Wash. 1993). *Thomas v. Peterson*, 753 F.2d 754 (9th Cir. 1985), the U.S. Forest Service concluded that construction of a 25 mile timber road would have no significant environmental impact. The Forest Service did not, however, consider the separate environmental impacts of timber harvesting, the transport of which was the reason the road itself had been proposed. *Id.* at 758-59. The court held that the environmental impacts of the road’s construction and the cutting and transporting of timber were connected actions that must be considered together in an EIS. Because the sale of timber could not proceed without the

³ One commentator has noted that: “there is no doubt that *Kleppe* ended one way that NEPA could be used...Had *Kleppe* gone the other way, NEPA might have compelled more agencies to think ahead, to plan even if they did not want to, and, thus, to understand better the long term consequences of their acts. As it now stands...NEPA cannot be used to require such planning...In other words, in some instances agencies can avoid NEPA’s requirement to act with foresight by defining their plans in a limited way... [although] courts have used the [CEQ regulations] definition of ‘proposal’ and the theory of cumulative impacts to control this tendency to some extent. In addition, *Kleppe* can put environmental plaintiffs in a bind of not knowing when to sue. If they sue too soon, they lose because there is no plan. If they sue too late, the plan may have gone so far that it is impossible to change it in any meaningful way. In the real world, of course, once a proposal is sufficiently concrete to trigger the preparation of an EIS, its contours may be set in concrete despite what the EIS says.” Thatcher, *Understanding Interdependence in the Natural Environment: Some Thoughts on Cumulative Impact Assessment Under NEPA*, 20 Env’tl. L. 611, 616-617, n. 18 (1990).

road and the road had no other justification except to provide access to the timber, the two actions were “inextricably intertwined.” *Id.* at 759

Cumulative actions must also be considered in determining the scope of an EIS. The CEQ regulations define cumulative actions⁴ as those “actions, when viewed with other proposed actions have cumulatively significant impacts and therefore should be discussed in the same impact statement.” 40 C.F.R. § 1508.25(a)(2). Cumulative impacts of distinct, independent projects – including past, present and reasonably foreseeable future impacts, even if those projects would not themselves be subject to NEPA – must be included in the scope of an EIS when the actions considered together with the proposed transportation project would have significant environmental impacts. *Fritiosfson v. Alexander*, 772 F.2d 1225 (5th Cir. 1985). *Fritiosfson*, involved an Army Corps of Engineers wetlands fill permit for a relatively small portion of a much larger wetland on a quickly developing West Galveston Island off the Gulf Coast of Texas. Taken alone, the small wetland fill would not have significant environmental impacts. The court held, however, that the Corps failed to consider the cumulative impact on the estuary of all past fill activities and reasonably foreseeable future fill permits likely to come before the Corps for subsequent development projects, even though there were no such actual permit applications pending at the time. *Id.*

Before moving on to analyze transportation and other indirect and cumulative effect cases in order to establish guiding principles and discern judicial trends, a final threshold legal issue must be addressed: the legal standard courts apply to an agency’s FONSI and decision not to prepare an EIS.

4.2.5 Judicial Standard of Review of Agency Decisions Not to Prepare an EIS: Arbitrary and Capricious Standard Now Applies to All Federal Circuits

NEPA requires that agencies take a “hard look” at all significant environmental consequences of proposed actions. Prior to 1989, the federal circuits were sharply divided as to the proper standard of judicial review to be applied to an agency’s finding of no significant impact (“FONSI”) in an EA, resulting in a decision not to prepare an EIS. A slim majority of federal circuit courts of appeal followed the most deferential “arbitrary and capricious” standard of review, as set forth in § 706(2) of the Administrative Procedure Act (“APA”). 5 U.S.C. § 706(2)(a). In applying this standard of review, the court “must consider whether the decision was based on a consideration of the relevant factors and whether there has been a clear error in judgment.” *Citizens to Preserve Overton Park v. Volpe*, 401 U.S. 402, 416, 91 S.Ct. 814, 823 (1971). Although this inquiry must be “searching and careful,” the ultimate standard of review is narrow. *Id.* “Along the standard of review continuum, the arbitrary and capricious standard gives an appellate court the least latitude in finding grounds for reversal.” *North Buckhead Civic Ass’n v. Skinner*, 903 F.2d 1533, 1538-39 (11th Cir. 1990). The Fourth Circuit, which includes the federal district courts of North Carolina, was among the federal circuits applying the arbitrary and capricious standard of review. See *Webb v. Gorsuch*, 699 F.2d 157, 159 (4th Cir.1983). However, five federal circuit courts of appeal – the 1st, 5th, 8th, 9th and 11th – applied a more stringent “reasonableness” standard of review, one that provides more leeway for a reviewing court to overturn an agency’s FONSI and decision not to prepare an EIS.

⁴See 3.2.2.1, *surpa*, for the definition of “cumulative impacts” at 40 C.F.R. § 1508.7, as opposed to the definition of the impacts of “cumulative actions” at 40 C.F.R. § 1508.25(a)(2). The adequacy of cumulative impact analysis in transportation cases is reviewed in 4.3.2, *infra*.

In *Marsh v. Oregon Natural Resources Council*, 490 U.S. 360, 374, 109 S. Ct. 1851, 1860 (1989), the Supreme Court resolved the split in the federal circuits in favor of the more deferential arbitrary and capricious standard of review. Although the *Marsh* holding applied to an agency's decision not to supplement an EIS, the Court emphasized, in dicta, that this decision was similar to the threshold question whether or not to prepare an EIS. *Id.* Because they each require that an agency take a "hard look" at all significant environmental impacts, both the initial decision to prepare an EIS and the decision to supplement an existing EIS present "classic example[s] of factual dispute[s] the resolution of which implicates substantial agency expertise." *Id.* at 375, 109 S.Ct. at 1860. Accordingly, the Court held that the arbitrary and capricious standard set forth in § 706(2) of the Administrative Procedure Act was more appropriate than the reasonableness standard because technical matters within the realm of an agency's expertise should be accorded substantial deference. *Id.* Subsequent to *Marsh*, the circuits that have addressed the issue have followed the Supreme Court's direction and extended the Court's application of the arbitrary and capricious standard to the threshold decision whether to prepare an EIS in the first instance. See *Greenpeace Action v. Franklin*, 982 F.2d 1342 (9th Cir. 1992); *Committee to Preserve Boomer Lake Park v. DOT*, 4 F.3d 1543 (10th Cir. 1993); *North Buckhead*, 903 F.2d at 1538-39. Following *Marsh*, the Fourth Circuit expressly affirmed its application of the arbitrary and capricious standard of review to an agency decision whether or not to prepare an EIS in light of the Supreme Court's ruling. See *State of North Carolina v. F.A.A.*, 957 F.2d 1125, 1128 (4th Cir. 1992).

Although the "ultimate standard of review is a narrow one," the Supreme Court in *Marsh* took pains to emphasize that application of the arbitrary and capricious standard must involve a "searching and careful" review and "courts should not automatically defer to the agency...without carefully reviewing the record and satisfying themselves that the agency has made a reasoned decision." 490 U.S. at 375, 109 S. Ct. 1860. A decision may be arbitrary and capricious if the agency "relied on factors which [the controlling statutes and regulations did] not intend it to consider, [or] entirely failed to consider an important aspect of the problem." *Motor Vehicle Mfrs. Ass'n of the U.S. v. State Farm Mutual Auto Ins. Co.*, 463 U.S. 29, 43, 103 S.Ct. 2856, 2867 (1983). Although an agency's action is arbitrary and capricious if it has "offered an explanation for its decision that runs counter to the evidence before [it], or it is so implausible that it could not be ascribed to a difference in view or the product of agency expertise," the reviewing court is not required "to determine the merits of conflicting views between two or more schools of scientific thought...to choose between differing expert views...[or to] decide if an [agency's decision] is based upon the best scientific methodology available." *Friends of Boundary Waters Wilderness v. Dombeck*, 164 F. 3d 1115, 1121, 1130 (8th Cir. 1999). In other words, the reviewing court defers to the agency's choice of evidence, methodology and expert opinion so long as it is not arbitrary or capricious or completely ignores a critical factual issue or type of significant impact.

The *Marsh* Court noted that in many factual circumstances, the difference between application of the reasonableness standard compared to the arbitrary and capricious standard would be "of no pragmatic consequence." 490 U.S. at 378, 109 S. Ct. at 1861. Despite the Supreme Court's assurance of no practical significance, employing the more deferential standard instead of the reasonableness test may be outcome determinative in certain factual or procedural circumstances. This is particularly true because the party challenging an agency's FONSI bears the burden of establishing that the agency's decision was arbitrary and capricious. *Boomer Lake*, 4 F.3d at 1555. One commentator believes that *Marsh*'s arbitrary and capricious standard only requires that a court reviewing an EA

and FONSI consider evidentiary, methodological or expert opinion challenges to an agency's environmental impact decision if they were actually raised during the EA comment period. *Whetstone, Greenpeace Action v. Franklin: Extending Marsh's "Arbitrary and Capricious" Review to an Initial EIS Decision*, 23 *Env'tl. L.* 1185, 1195 (1993). Under the more stringent reasonableness standard, a court has more discretion to consider evidence or opinions not officially part of the EA administrative record when reviewing an agency's FONSI. *Id.* at 1196-97. "To overcome the more deferential treatment of the [Marsh] approach, challengers must show shortcomings in the agency's EA or FONSI based upon the information the challengers presented to the agency before its decision was made." *Id.* at 1198. Although Marsh does not address this question and courts may decide on a case-by-case basis whether to consider evidence outside of the EA's administrative record upon judicial review, plaintiffs arguing that a FONSI is arbitrary and capricious may be unsuccessful if they are not actively involved in the EA comment process, even though their arguments may have prevailed under the reasonableness standard. See generally *Oregon Natural Resources Council v. Lowe*, 109 F.3d 521, 526-27 (9th Cir. 1997) (Review may extend beyond the administrative record in NEPA cases where the plaintiff alleges that the agency has "neglected to mention a serious environmental consequence...or otherwise swept stubborn problems or serious criticism...under the rug." citing *Silva v. Lynn*, 482 F.2d 1282, 1285 (1st Cir. 1973)).³

4.3 Adequacy of the Substantive Evaluation of Cumulative and Indirect Effects in an EIS

4.3.1 Standard of Judicial Review of an EIS's Content

Although the arbitrary and capricious standard now applies to all federal courts reviewing an agency's EA and FONSI, resulting in a decision not to prepare an EIS (along with review of an agency decision not to supplement an existing EIS, see *Marsh*, 490 U.S. at 375, 109 S.Ct. at 1860) the Fourth Circuit and all other federal courts review the adequacy of the content of an EIS using a reasonableness standard. Under this "rule of reason," courts analyze an EIS to determine whether it contains a reasonably thorough discussion of significant aspects of probable environmental consequences. *Carmel-By-the-Sea*, 123 F.3d at 1150-51. Federal courts use the CEQ regulations and the general legal standards for determining the significance, reasonable foreseeability and probability of environmental impacts to determine whether an EIS complies with NEPA. When reviewing the substantive adequacy of an EIS under the "rule of reason" standard, courts "make a pragmatic judgment" whether the statement's "form, content, and preparation foster both informed decision making and informed public participation. Once satisfied that a proposing agency has taken a 'hard look' at a decision's environmental consequences, [the court's] review is at an end." *Id.* "Thus, in considering a challenge under NEPA, [the court] may not substitute [its] judgment for that of the agency concerning the wisdom or prudence of a proposed action." *Laguna Greenbelt, Inc. v. United States Dep't of Transp.*, 42 F.3d 517, 523 (9th Cir. 1994).

Under this rule of reason, the court must be satisfied that the agency has gone "beyond mere assertions" and has "explicated fully its inquiry, analysis and its reasoning." *Dubois*, 102 F. 3d at 1287. Thus, mere listing or cataloging of possible impacts in an EIS will not pass muster under NEPA. *Boundary Waters*, 164 F.3d at 1128. In making its "pragmatic judgment" of the substantive

³As a general rule, courts reviewing an agency action under § 706(2)(a) of the APA must limit its analysis to the administrative record. *Friends of the Earth v. Hintz*, 800 F.2d 822, 828 (9th Cir. 1986).

adequacy of an EIS, the court analyzes the statement's evaluation of significant environmental impacts, while reviewing the administrative record upon which it was based, in order to determine whether the agency's analysis and decision is "too unreasonable for the law [NEPA] to permit it to stand." *Dubois*, 102 F.3d at 1287. However, "the existence of supportive studies and memoranda contained in the administrative record but not incorporated in the EIS cannot bring into compliance with NEPA an EIS that by itself is inadequate." *Id.*⁴ Accordingly, general statements about "possible" effects and "some risk" in an EIS's discussion of environmental impacts will not satisfy NEPA's requirements. *Neighbors of Cuddy Mountain v. U.S. Forest Service*, 137 F.3d 1372, 1380 (9th Cir. 1998). Nevertheless, the reviewing court "should not 'fly speck' an EIS and hold it insufficient based upon inconsequential or technical deficiencies." *Dubois*, 102 F.3d at 1287.

4.3.1.1 Factual or Methodological Disputes Among Experts

Although "[a]ccurate scientific evidence is essential to an Environmental Impact Statement" and NEPA demands a reasonably thorough discussion of the environmental consequences in question, "unanimity of opinion, expert or otherwise" is not required. *Carmel-By-the-Sea*, 123 F.3d at 1151. As with review of an agency's EA and FONSI courts evaluating the adequacy of an EIS need not determine the most meritorious expert opinion, methodological approach or school of scientific thought; instead, the court must defer to the agency's informed choice of experts, evidence, and methodology. *Id.* *Carmel* involved a challenge to an FEIS for a proposed state highway realignment. The plaintiffs argued that the FEIS's analysis of the realignment's wetlands impacts was inadequate and misleading because DOT failed to account for newly emergent wetlands created by a recent earthquake. *Id.* While acknowledging that an agency may not rely on "stale" scientific evidence or "ignore reputable scientific criticism," the court nevertheless rejected the challenge. *Id.* Finding DOT's wetlands analysis "reasonably thorough," the court deferred to the agency's own expert analysis, despite the "conflicting evidence." *Id.*

In *Boundary Waters*, 164 F.3d at 1129-30, one group of plaintiffs argued that a FEIS was inadequate because it relied, in part, upon a study of visitor traffic that used inadequate data, made unverified assumptions and employed a "seriously flawed" computerized travel zone model. With regard to the challenged computer model, the FEIS acknowledged the "possible pitfalls" inherent in the model, while explaining that it had been "fully updated" and its data interpreted "to avoid extreme results that might otherwise be produced by the model in some instances." *Id.* Given this evaluation of the model's methodology and results, the court rejected the plaintiffs' challenge, noting that "NEPA does not require that we decide whether an EIS is based on the best scientific methodology available." *Id.* at 1130. The court also rejected the challenge to the traffic study's choice of data and assumptions. "Even assuming the data was flawed in some respects," the traffic study was not the only source of information relied on in the FEIS. *Id.* "When an agency relies on a number of findings, one or more of which are erroneous, [the court] must reverse and remand only when there is a significant chance that but for the errors the agency might have reached a different result." *Id.*

⁴ As discussed in n. 3, *supra*, the court may extend its review beyond the administrative record in NEPA cases where the party challenging the adequacy of an EIS (or EA) alleges that the agency has "swept stubborn problems or serious criticism...under the rug," *Silva*, 482 F.2d at 1285.

4.3.1.2 Incomplete or Unavailable Information

Information that is relevant or necessary to make an informed decision concerning significant environmental impacts may in some instances be infeasible to collect or analyze due to prohibitive costs, unattainable due to scientific or methodological limitations, or otherwise unavailable or impractical to obtain. When faced with this situation, early CEQ regulations required that agencies prepare a “worst-case analysis” in an EIS to account for the lack of information. The CEQ rescinded this worst-case analysis requirement in 1986 because agencies were routinely committing an unreasonable amount of time and money to design and perform technical studies, some of questionable merit, to satisfy the worst case requirement. See Note, Federal Agency Treatment of Uncertainty in Environmental Impact Statements Under the CEQ’s Amended NEPA Regulation § 1502.22: Worst Case Analysis or Risk Threshold?, 86 Mich. L. Rev. 777, 809-811 (1988). Under the 1986 CEQ regulations, agencies are required to obtain unavailable or incomplete information if technically feasible and the costs of gathering the data or designing and conducting the studies are not exorbitant. These new regulations replaced the worst case analysis with the requirement that agencies faced with incomplete or “unavailable information concerning a reasonably foreseeable significant environmental consequence...[must prepare]...a summary of existing credible scientific evidence...[and present]...an evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community.” 40 C.F.R. § 1502.22. The Supreme Court upheld the CEQ’s 1986 revised regulations revoking the worst case analysis requirement in *Robertson*, 490 U.S. 332, 109 S. Ct. 1835.

4.3.2 The Adequacy of Cumulative Effects Analysis in Transportation Cases

Carmel-By-the-Sea, 123 F.3d 1142, involved the realignment of a three mile section of California State Highway 1, from the City of Carmel-by-the-Sea to Hatton Canyon. In *Carmel*, the plaintiffs challenged the adequacy of the FEIS’s evaluation of the realignment project’s cumulative effects on nearby wetlands and the Hatton Canyon’s Monterey pine forest. *Id.* at 1148-50. The court held that the FEIS’s brief cumulative impacts analysis failed to provide a sufficient level of detailed evaluation to pass muster under NEPA and remanded for further evaluation of the cumulative impact of past, present and future projects together with the effects of the Hatton Canyon realignment on surrounding wetlands, Monterey pine tree stands and a particular species of onion found in the area. *Id.* at 1160-61. Although the FEIS referred generally to the area’s “development projects” resulting from Carmel’s “ongoing urbanization” and “substantial growth [over] the last 30 years,” past projects were neither adequately catalogued or evaluated, described instead with only perfunctory generalities “insufficient to permit adequate review of their cumulative impact.” *Id.* at 1160. While the FEIS did a better job of identifying, listing and describing planned future residential and commercial projects in the area, along with other forecasted transportation improvements, “[m]issing, however, [was] any discussion of how these projects together with the proposed Hatton Canyon project will affect the wetlands, Monterey pine and [the threatened] onion [species].” *Id.* By merely noting that “development pressures” provide “threats” to the area’s resources (particularly the onion species), the court held that the FEIS failed to provide any “meaningful analysis” of the cumulative or

synergistic effects of both past, present and future development when considered with the effects of the proposed realignment. *Id.* at 1161.⁵

In a case originating out of North Carolina, the Fourth Circuit held that a cumulative impact analysis was not necessary for an airspace restriction action where a Supplemental EIS (“SEIS”) was being prepared for another airspace restriction that would include that challenged project. In *State of North Carolina v. FAA*, 957 F.2d 1125, 1127-29 (4th Cir. 1992), the failure the Federal Aviation Administration (FAA) to prepare an EIS for its issuance of a final rule revoking, realigning and establishing restricted airspace for Naval operations over portions of eastern North Carolina did not violate NEPA, where the FAA reviewed and adopted a FONSI for the airspace restrictions prepared by the Navy. (The FAA performed “more than a mere procedural review” of the Navy’s FONSI, “taking responsibility for the scope and content of the Navy’s assessment”). *Id.* Among plaintiff North Carolina’s challenges was the fact that this review failed to analyze the cumulative effect of the Navy’s restriction in combination with other existing and three proposed restrictions in the airspace over eastern North Carolina and its coastal waters. *Id.* at 1130-31. However, because the Marine Corps was in the process of preparing a SEIS for one of the proposals that would evaluate the cumulative effects of all of the region’s proposed airspace restrictions, including the FAA’s Naval restriction at issue, the court held that the FAA’s failure to address these cumulative impacts did not violate NEPA. *Id.* “A cumulative impact analysis is therefore not necessary at this point, and it would be a waste of resources given the necessity for analysis of the cumulative impact of this and [the] other proposals...[in the Marine Corp’s SEIS].” *Id.* The court was careful to note that the FAA could revise the restriction at issue upon completion of the Marine Corps SEIS “without facing the usual problem that resources have been committed or the die otherwise cast.” *Id.*

4.3.3 Analysis of Guiding Standards and Trends in Cases Involving Growth-Inducing and Other Indirect Effects

The number of reported federal cases dealing with indirect effects is relatively small, particularly in the realm of transportation projects. The cases reviewed below provide general legal guidance for determining when a project’s growth-inducing or other indirect effects (including the adverse environmental impacts resulting from induced residential and/or commercial growth) are significant and sufficiently probable that they must be analyzed in an EIS. Two of the cases analyzed below, *Mullin v. Skinner* and *Rankin v. Coleman*, involve North Carolina state transportation proposals on barrier islands, the EISs for which federal courts held were woefully inadequate in their analysis of the projects’ indirect effects. In other cases, promotion of the economic benefits resulting from growth-inducing impacts as “selling points” for a proposed transportation project helps establish that the indirect effects are sufficiently probable and describable to be presently evaluated in an EIS before the project advances to a point where it will inevitably go forward and the adverse impacts can not be considered, reversed or significantly mitigated. The most recent indirect effect cases provide little guidance, however, regarding the level of detail with which the secondary impacts must be analyzed in an EIS to satisfy NEPA’s requirements. Furthermore, no clear standards emerge from the case law regarding the use of local or regional planning documents and studies to support

⁵ In support of its holding, the *Carmel* court cited *Thomas v. Peterson*, 753 F.2d at 754-55, discussed in Section 4.2.4.2, *supra* (remanding for evaluation of the cumulative impact of the construction of a timber road and the cutting and transporting of timber, which were connected actions “inextricably intertwined.” *Id.* at 759).

arguments that growth-induced development was already planned, would have occurred anyway, or that indirect effects need not be evaluated in an EIS because existing zoning and other local land use controls prohibit development of the type the project's challengers argue will be induced.

4.3.3.1 General Standards in Indirect Effect Cases

Of course, any indirect effects must be both probable and significant to warrant evaluation in an EIS. In *Gloucester County Concerned Citizens v. Goldschmidt*, 533 F. Supp.1217 (D. N.J. 1982), the plaintiffs challenged an FEIS for a proposed highway project "based upon the purported absence of consideration of 'secondary impacts' of the...project," specifically: 1) how the highway would fit into the state's existing highway network; 2) what effect it would have on existing and planned mass transit lines; and 3) the impact upon development and population growth. *Id.* at 1222. The plaintiffs also complained that:

although the FEIS acknowledges that the highway will act as a catalyst to development in the surrounding area, it does not go on to study the secondary effects of the road such as increased development, with its concomitant increase in population and demand for state, county and municipal services, such as schools, police and fire protection and sewage facilities.

Id. at 1228. The court found that there was adequate reference, accompanied by several maps, of the relationship between the proposed highway and its specific place within the state's highway network, and that it would not detract from usage of existing rapid transit lines. Further planning of rapid transit lines was unlikely without the presence of the new facility. Population figures in the FEIS demonstrated that the area had grown and would continue to grow with or without the proposed project, since there were existing roads that serviced the area. Accordingly, the court held that the plaintiffs had failed to demonstrate that any of the secondary impacts would be "significant," and that the failure of the FEIS to speculate on future events, "which, based on the information available at the time of the FEIS, appear improbable, does not articulate a serious deficiency in the FEIS." *Id.* at 1229.

In *Sierra Club v. Marsh*, 729 F.2d 868 (1st Cir. 1985) (*Sierra Club III*), the First Circuit reviewed a NEPA challenge to a proposed port and causeway on a rural island in Maine. The agency's EA resulted in a FONSI and decision not to prepare an EIS for the project. The court evaluated the adequacy of the EA under the First Circuit's "reasonableness" standard applied before 1989, rather than the arbitrary and capricious standard of review required by the Supreme Court after *Marsh*, 490 U.S. 360, 109 S.Ct.1851. The court set forth a three part test to determine whether a particular set of impacts is definite enough to be evaluated, or too speculative to warrant consideration:

- 1). With what confidence can one say that the impacts are likely to occur?
- 2). Can one describe them "now" with sufficient specificity to make their consideration useful?
- 3). If the decision maker does not take them into account "now," will the decision maker be able to take account of them before the agency is so firmly committed to the project that further environmental knowledge, as a practice matter, will prove irrelevant to the government's decision?

Id. at 878. This three part test is based upon the general legal standards reviewed above for determining whether indirect impacts are sufficiently likely to occur to be reasonably foreseeable.

Applying this test, the court reviewed the administrative record, including a “Municipal Response Plan” which noted that development of the industrial park would follow construction of the port, thus constituting a “two-part development package.” Id. at 868. The record also included an EA prepared by the Maine Department of Transportation which projected further industrial development after construction of the cargo port:

Development of the cargo terminal will...act as the principal stimulus to further industrial development on the island itself. Several forest product and food industries are also expected to have facilities on the island, as well as suppliers of paper making machinery and machinery components...Industrial development, indirectly stimulated by constructing the cargo terminal, will generate revenues [for the town]. The eventual fiscal impact on the town will, of course, depend upon the degree and timing of the expected co-development of the island.

Id. at 868. These projections of industrial development resulting from the port’s construction in the record clearly satisfied the first test; there was ample “confidence” that indirect impacts were likely to occur.

With regard to the second test, the court reviewed a 35 page “Land Use/Industrial Marketing Study” prepared by the owner of the southern half of the island in addition to the town’s “Municipal Response Plan.” Together, these documents in the administrative record provided detailed descriptions of likely further development, analysis of the physical characteristics of the lower half of the island, discussion of the feasibility of construction at various sites around the island, analysis of development options, and evaluations of the likely impact industrial development would have on the island’s environment, employment and housing conditions, and the provision of medical, emergency and sewage and other municipal services. The court noted that the CEQ regulations do not require that the agency engage in speculation, but direct the agency to consider “likely purchasers [of land] and the development trends in the area...in recent years.” Id. The court then noted that the “land use” and “response” plans were detailed enough for evaluation to satisfy the second test questioning whether the impacts can now be described with sufficient specificity to render their consideration in an EIS useful.

As for the third test, the court held that once the causeway and port were built the pressure to develop the rest of the island could prove irresistible and unstoppable. Accordingly, putting off their evaluation in an EIS for some later time would result in environmental knowledge that would not offer the decision maker a meaningful choice whether to proceed.

Because the indirect effects of industrial development expected to result from construction of the port and causeway had been identified and specifically described in the planning documents, which projected with considerable confidence that such development would occur, the Sierra Club III court held that the failure to prepare an EIS evaluating these impacts violated NEPA. Analysis of these effects could not be conducted at a later date because once construction of the port and causeway neared completion, it would be too late to account for the indirect development, which would be a foregone conclusion.

After remand and further appellate review of *Sierra Club III*, 729 F.2d 868, the Sierra Club again challenged the FEIS for the project. See *Sierra Club v. Marsh*, 976 F.2d 763 (1st Cir. 1992) (*Sierra Club IV*). The FEIS in *Sierra Club IV* restricted its indirect effect analysis to four light-dry industries. The plaintiffs complained that the agency's evaluation of the project's indirect impacts was inadequate because it failed to evaluate heavy industries. The administrative record revealed that the water and sewage treatment facilities on the island were inadequate to sustain heavy industry. Furthermore, the cost of upgrading the water facilities alone to sustain heavy industry was prohibitive. Local officials and property owners directed their marketing toward light-dry, not heavy industry. The court held that:

NEPA requires an EIS to evaluate only those secondary impacts that are reasonably foreseeable. We conclude that it was permissible for the agencies not to analyze other water dependent industries, such as auto processing, petroleum and cement, because the likelihood of these industries developing on [the] Island is too speculative to be reasonably foreseeable.

Id. at 778. Because the EIS's identification of the four light-dry industries reasonably discussed the type of industrial development likely to occur, the court upheld the agency's evaluation of the project's indirect effects.

4.3.3.2 Induced-Growth as a Project Selling Point

Part of the court's rejection of the refusal to prepare an EIS evaluating indirect effects in *Sierra Club III*, *supra*, was based upon the fact that the economic benefits of the industrial development that would be induced by the project were constantly used as "selling points" for construction of the port and causeway.

Other courts have also focused on use of indirect impacts to help "sell" or promote the project. In *Sierra Club v. Sigler*, 695 F.2d 957 (5th Cir. 1983), the U.S. Army Corps of Engineers issued permits authorizing private construction of a multi-purpose, deep water port and crude oil distribution system near Galveston, Texas. Among other challenges, the plaintiffs argued that the FEIS violated NEPA because it failed to examine the adverse environmental impacts that would result from the project's secondary effects. The court noted that the FEIS cited many benefits that would flow from the terminal's construction. While the court did not call for an objective cost-benefit analysis, it held that because the project's benefits were analyzed as "selling points" in the FEIS, there could be no "hard look" required by NEPA without identifying and analyzing the adverse impacts resulting from the project's indirect effects.

Chelsea Neighborhood Associations v. United States Postal Service, 516 F.2d 378 (2nd Cir. 1975) involved a U.S. Postal Service proposal to build a new vehicle maintenance facility. The proposal included a plan by the City of New York to construct apartment units in the floors above the facility. The EIS for the project lauded the benefits of constructing housing in the "air rights" above the facility without discussing any of the project's disadvantages. *Id.* at 387-88. The court held that "...using the housing as a 'selling point' without disclosing its possible negative aspects is certainly not the 'environmental full disclosure' required by NEPA." *Id.* at 388.

4.3.3.3 Failure to Identify and Analyze Indirect Effects

One early NEPA case from North Carolina and two major indirect effect cases from the Ninth Circuit are routinely cited by plaintiffs challenging transportation projects on the basis of an EA or EIS's inadequate or incomplete analysis of the induced-growth likely to be created by the project.

In the North Carolina case, *Rankin v. Coleman*, 394 F. Supp. 647, modified 401 F. Supp. 664 (E.D. N.C. 1975), the plaintiffs sought to enjoin the North Carolina Department of Transportation ("NCDOT") and the US DOT from further construction of a highway improvement project proposed for Bogue Island, one of the barrier islands on North Carolina's Outer Banks. A long, narrow barrier island in Carteret County covered with sand dunes and vegetation constantly subject to shifting sand erosion and deposit, Bogue Island was "largely undeveloped" at the time of the court challenge except for the resort community of Atlantic Beach at the island's eastern end. 394 F.Supp. at 655. Although the court noted that the island could sustain "carefully planned and limited development," it found that significant alteration of Bogue's dunes and vegetation could lead to "rapid erosion by the normal action of ocean and wind and to virtual obliteration by storms." *Id.* Through the middle of this "admittedly ecologically delicate environment" the defendants proposed the construction of a 44 foot wide, asphalt paved, four or five lane highway that would span the length of the island, replacing the existing 20 foot wide secondary road. *Id.*

Although the EIS prepared for the project noted that "a modern highway can enhance the economic progress of resort and recreational areas...and existing and planned development ...will benefit from the project," it contained "no discussion at all regarding the secondary effects of increased development of the island, such as increased demand for fresh water, increased amounts of sewage and increased demand for other community services." *Id.* at 657. In addition to not identifying and analyzing these indirect effects on the limited resources and fragile ecology and environment of the island, the EIS failed to determine and evaluate the effect that increased development would have on the island's natural dune and vegetation system as a barrier against increasing erosion. Furthermore, the EIS failed to adequately identify and analyze the direct effects of the proposed highway's construction on dune and vegetation clearance and the impact these direct effects would have on the island's erosion and protection from storm damage. As such, the court held that the EIS "completely overlooked...numerous social, economic and environmental" direct and indirect effects of the highway, granted the injunction and remanded for completion of an adequate EIS.⁶

In *City of Davis v. Coleman*, 521 F.2d 661 (9th Cir. 1975) involved a proposal to build an Interstate highway interchange to stimulate and service future development in a rural area. Neither an EA nor an EIS was prepared. Instead, a three-page "Negative Declaration of Environmental Impact" was issued. This declaration neither identified nor discussed the commercial and industrial development that would likely spring-up around the interchange, located in a "sparsely populated agricultural area," instead assessing only the direct impacts related to the construction of the

⁶ In further proceedings, the injunction was modified and construction of a two-lane replacement highway was allowed to proceed subject to restrictions, including limiting the allowed highway and shoulder width. 401 F. Supp. 664 (E.D. N.C. 1975).

cloverleaf itself. The court held that the failure to identify and analyze the project's indirect effects violated NEPA, noting that:

The growth-inducing effects of the...interchange are its *raison d'être*, and with growth will come growth's problems: increased population, increased traffic, increased pollution, increased demands for services such as utilities, education, police and fire protection and recreational facilities.

Id. at 674-75. The court further admonished the failure to identify and evaluate the indirect effects of the project by noting that "common sense" dictates recognition of the "obvious" development that would result from constructing a "large interchange on a major Interstate highway in an agricultural area where no connecting road currently exists." *Id.* Not being able to predict the exact type of development that would occur was no excuse for failing to prepare an EIS evaluating the indirect effects of the project. *Id.* at 676-77. The court ruled that current and contemplated plans of private parties and local government must be reviewed and, based upon that review, reasonable forecasting of development likely to result from construction of the interchange must be conducted in an EIS.

The second Ninth Circuit case, *Coalition for Canyon Preservation v. Bowers*, 632 F.2d 774 (9th Cir.1980), involved a proposal to widen a 10.8 mile section of a narrow, two-lane federal highway that connected four small, rural towns in northern Montana and served as the primary access road into Glacier National Park. The new segment would create an 88 foot wide, four-lane highway, including 10 foot parking lanes with new curbing and other improvements in the sections passing through the towns, resulting in the relocation of several business. The EIS admitted that "the possibility exist[ed]" that the wider four-lane highway could result in "development along the highway...increas[ing] at a faster pace than in the past." *Id.* at 782. However, "nothing further was said about increased development" in the EIS. *Id.* The court held that the EIS's failure to assess this foreseeable development violated NEPA:

The aerial maps of the area show that the [four] towns...are centered about the main road; tourism is their main source of income and roadside businesses are common. It is likely that this project will have major effects on the character of these towns. This case requires analysis of these secondary effects.

Id. at 783.

Along with the general legal standards for indirect cases reviewed above, these three decisions emphasize that an EIS must identify and analyze the growth-inducing effects of transportation projects that are significant, reasonably foreseeable and probable. The few indirect cases involving transportation projects do not, however, provide clear guidance for determining how detailed the analysis of secondary impacts must be to satisfy NEPA's requirements.

4.3.3.4 Level of Detail Required in an EIS's Evaluation of Indirect Effects

Sierra Club IV, 976 F.2d at 767, sets the stage for the remaining indirect effects cases reviewed next by noting that:

even as to those effects sufficiently likely to occur to merit inclusion, the EIS need only “furnish such information as appears to be reasonably necessary under the circumstances for evaluation of the project.”

Id. (citations omitted). Just how much evaluation of indirect effects is sufficient to satisfy NEPA? As noted above, mere listing or cataloging of possible impacts in an EIS will not pass muster. *Dombeck*, 164 F.3d at 1128. However, the few recent indirect effects cases involving transportation projects have not raised the bar very high beyond a mere descriptive listing.

In *Sierra Club, Ill. Chapter v. U.S. Dept. of Transportation*, 962 F.Supp. 1037, 1040-41 (N.D. Ill. 1997), for example, plaintiffs challenged the adequacy of an EIS for a proposed 12.5 mile toll road that would extend Interstate 355, connecting it to Interstate 80 in southwest suburban and exurban Chicago. In addition to disputing the sufficiency of the FEIS’s evaluation of project alternatives and many of the direct effects of the proposal, the plaintiffs argued that the FEIS failed to adequately analyze the indirect effects of the toll road. *Id.* at 1045. The FEIS did “identify the [secondary] environmental impact of the toll road, including proposed land use changes, conversion of agricultural lands, development of certain facilities, possible urban sprawl, and development of toll road interchanges.” *Id.* (emphasis added). Although the court agreed with the plaintiffs that the agency failed to describe any of these indirect effects “in considerable detail,” the court held that the FEIS’s evaluation of the project’s secondary impacts was “adequate, albeit cursory.” *Id.* In rejecting the plaintiffs’ challenge, the court distinguished the Ninth Circuit’s holdings in *City of Davis*, 521 F.2d at 675, and *Bowers*, 632 F.2d at 783, noting that the EISs in those cases “completely failed to identify” secondary impacts. *Id.*

This case provides little guidance for determining how much evaluation of the “identified” indirect effects is sufficient to satisfy NEPA upon judicial review. Of course, the extent of the analysis “reasonably necessary” to adequately evaluate secondary impacts is dependent upon the particular circumstances of each case. See *Sierra Club IV*, 976 F.2d at 767. One problem is that published opinions do not, of course, append the administrative record and the few indirect effect transportation cases rarely quote key or exemplary language from the EIS’s evaluation of secondary impacts. While *Sierra Club, Ill. Chapter*, 962 F.Supp. at 1040-41 may be instructive as a case study focused on the content of the FEIS’s indirect effect analysis, the published opinion provides little, if any, guidance.

Of even less help is *Northern Crawfish*, 858 F. Supp. 1503. This case involved the proposed construction of a 15 mile, four-lane South Lawrence Trafficway (“SLT”) in Kansas. Among other challenges, the plaintiffs argued that the FEIS failed to adequately evaluate the indirect and cumulative impacts of the project. *Id.* at 1523. Based upon review of the administrative record, the court granted the defendant’s motion for summary judgment, noting only that “the FEIS has considered the cumulative impact and the indirect effects of the SLT.” *Id.* at 1524. Although the court reviewed the types of indirect effects that must be considered under NEPA and the CEQ regulations, the court failed to even identify the secondary impacts discussed in the EIS, let alone describe why the analysis of these impacts was adequate under NEPA.

On the other hand, recent indirect effect transportation cases involving disputes over the extent to which proposed projects are growth serving or growth inducing provide more guidance.

4.3.4 Effect of Land Use and Zoning Controls on Indirect Impacts Analysis

Federal courts have reached distinguishable conclusions when reviewing an agency's reliance on local or regional plans or planning documents, economic development studies, or zoning and other land use controls to support their evaluation of indirect effects in an EIS. In two recent cases, the Ninth Circuit rejected EIS challenges based upon arguments that the agencies' evaluation of secondary impacts improperly and unreasonably relied upon planning studies and documents to support their conclusions that any growth that may be induced by the project was already planned for, would occur anyway, and/or would not be significant because of limited land available for such development, even though the plans and studies relied upon assumed construction of the challenged project proposals.

The first case, *Laguna Greenbelt*, 42 F.3d 517, concerned the 17.5 mile San Joaquin Hills transportation corridor project running from Newport Beach to connect with Interstate 5 in Orange County, south of Los Angeles. The plaintiffs challenged the adequacy of the EIS's evaluation of the growth-inducing effects of the project. Specifically, the plaintiffs argued that the EIS's discussion of indirect impacts "set forth insufficient information," and its conclusion that the toll road would "not influence growth was misleading because it [was] based on local planning documents that assume existence of the toll road." *Id.* at 525. The court disagreed, noting that:

The discussion and documentation in the EIS, however, support the EIS's conclusion that the toll road will not affect the amount and pattern of development in Orange County. The EIS relied upon evidence that Orange County has already experienced substantial growth, and that the county is expected to continue to grow in the future, although at a declining rate. The record shows that 98.5% of all land in the project's "area of benefit" is already accounted for by either existing or committed land uses not contingent on construction of the corridor.

Id. (cites to administrative record omitted). The plaintiffs argued that the planning documents relied upon in the EIS only authorize development, but do not "require or guarantee it, and that developers may not go through with plans if the toll road is not built." *Id.* at 525 n.8. The court dismissed this argument, noting that the EIS admitted that completion of the corridor may affect the rate, but not the pattern and amount, of development that would occur. *Id.* 526, n. 9. While acknowledging that there were "weaknesses in the EIS's analysis of growth-inducing impacts," and that the plaintiffs may disagree with the EIS's conclusions, the court held that the discussion of the indirect effects was "reasonably thorough" and thus satisfied NEPA under the "rule of reason" standard of review. *Id.* at 526 (specifically distinguishing *Bowers*, 632 F.2d at 783 and *City of Davis*, 521 F.2d at 675).

Similarly, in *Carmel-By-the-Sea*, 123 F.3d 1142, the plaintiffs challenged the adequacy of the EIS's evaluation of growth-inducing impacts for a project involving the realignment of a three mile section of California State Highway 1, near Monterey. The FEIS acknowledged that the project "had the potential to facilitate growth," but concluded that any such growth was already planned and accounted for in the two applicable, local master plans, even though these planning documents were based upon the assumption the corridor would be built. *Id.* at 1162-63. The court distinguished the undeveloped agricultural area at issue in *City of Davis*, 521 F.2d at 675, from the area at issue in *Carmel*, noting that "very little opportunity for development would occur within the [largely developed] highway corridor." Although there was no identification or analysis of the likely induced-

development in Davis, 521 F.2d at 675, the court held that the EIS in Carmel adequately identified and evaluated the limited induced-growth that would result from the corridor project by referencing and discussing that such growth was already planned for in the local master plans. *Id.*

Instead of arguing that growth induced by the project was already planned for, would occur anyway, or would not be significant because of the limited available land, the following cases involve agency claims that indirect effects of proposed transportation projects need not be evaluated because existing zoning and other local land use plans and controls prohibit development of the type the projects' challengers argue would be induced. No clear standards or guidelines emerge from these next cases, which reach distinguishable conclusions regarding claims that growth alleged to develop as an indirect effect of a challenged transportation project need not be evaluated in an EIS because it could not occur without changes in local land use and zoning controls, and therefore would not occur on its own as an indirect impact of the proposed project.

In a North Carolina case, *Mullin v. Skinner*, 756 F. Supp. 904 (E.D. N.C. 1990), property owners sought to enjoin the North Carolina Department of Transportation (NCDOT) and the FHWA from proceeding with the construction of a high-rise bridge connecting the mainland and Sunset Beach, a small North Carolina barrier island popular as a tourist destination, but housing only some 50 permanent residents. *Id.* at 906-907. The EA completed for the project resulted in a FONSI and decision that no EIS need be prepared. *Id.* at 911-12. The plaintiffs challenged the FONSI, arguing that the improved access to the island provided by the bridge would "induce high-density development" on the island, resulting in numerous adverse environmental impacts. *Id.* at 918-20. As such, the plaintiffs argued that the EA and decision not to prepare an EIS for the project violated both NEPA and North Carolina's State Environmental Protection Act ("SEPA"), N.C. Gen. Stat. §§ 113A-1 et seq.

In addition to maintaining that development would occur on the island regardless of whether the bridge was built, defendants FHWA and the State of North Carolina argued that "significant changes in development patterns can be brought about only through zoning changes, and not by the construction of a high-rise bridge." Rejecting this argument, the court stated that:

Defendants'...point is so utterly devoid of common sense and inconsistent with NEPA that it can not be taken seriously. This court did not need plaintiffs' experts to tell it that zoning changes inevitably follow development pressures. To believe otherwise is to ignore reality. More importantly, defendant's argument that it is these zoning changes which will cause increased development, and not the bridge, completely ignores the [CEQ] regulatory definition of 'indirect effects' which they are required to abide by [under NEPA]: 'indirect effects...are caused later in time...[and] may include growth-inducing effects' [CEQ cite omitted]. Even though zoning changes may be necessary to alter existing uses of land, if a major action makes it likely that such a change will occur, the action will have an effect on the environment.

Id. at 921. The Court further noted that the EA contained predictions of growth, including enhanced economic and employment opportunities, increased tourism, greater usage of existing recreational areas, and increased property values and tax base. "These predictions simply cannot be squared with the conclusion that land use, development, and traffic will not be significantly altered

by the new bridge.” *Id.* Although the court does not make the argument, its analysis is in accord with the “selling points” standard reviewed in *Sierra Club III*, 729 F.2d at 868.

In contrast, *Florida Wildlife Federation v. Goldschmidt*, 506 F. Supp. 350 (S.D. Fl. 1981), also involved expert testimony claiming that land use planning would not be an effective means of controlling the type and density of development likely to occur because of its vulnerability to political pressures. The plaintiffs claimed that the proposed extension of Interstate 75 would induce massive residential, commercial and industrial development in the area. However, the result was quite different from *Skinner*, 756 F. Supp. at 921. The defendant’s arguments centered on the existing Land Use Plan for Broward County. Developed over a three-year period, following numerous studies and at least 30 public hearings, the plan had the full force and effect of law throughout the county. Procedures for adopting amendments were stringent and required six to nine months to complete. The four amendments adopted since its inception actually reduced the number of residences allowed in the study area. The court held that the evidence pointed strongly against induced development:

In short, plaintiffs’ fears that I-75 will induce massive, total development of the study area have little evidentiary support. Though it may be true as a general rule that access to transportation causes development, the history of and projected increases in population growth for south Florida demonstrate that growth will occur because of market demands even when transportation is lacking. There is already some development in the study area, and development will continue there as planned and allowed under Broward County’s Land Use Plan, whether or not I-75 is constructed, because it is the next logical area for development...Though plaintiffs distrust the political process, all the evidence indicates that the Land Use Plan is, and will continue to be, enforced.

Id. at 368-369.

No clear standards emerge from the case law regarding the use of local or regional planning documents and studies to support arguments that growth-induced development was already planned, would have occurred anyway, or that indirect effects need not be evaluated because existing zoning and other local land use controls prohibit development of the type the project’s challengers argue will be induced. The ability to rely on local plans and land use controls depends, of course, on the particular facts of the case. However, courts will consider local and regional plans and land use controls where strong arguments can be advanced that the controls will be strictly enforced and not easily subjected to variance or amendment by political influence resulting from development pressure caused, indirectly, by the proposed transportation project.

4.3.5 Environmental Justice, Indirect Effects and Disparate Adverse Impacts on Minority and Low-Income Communities

Over the past fifteen years, community, civil rights and environmental activists have increasingly challenged the adverse environmental, health and socioeconomic effects of federal and state projects on predominantly minority and low-income communities by arguing that these disparate impacts violate the Equal Protection Clause of the Fourteenth Amendment of Constitution, Title VI of the Civil Rights Act of 1964 and/or Title VIII of the Fair Housing Act of 1968, often in conjunction with claims that such projects also violate environmental statutes and regulations,

including NEPA.⁷ The activism and litigation surrounding these efforts has become known as the environmental justice movement and its growth and development has been accompanied by an increasing awareness and acknowledgment on the part of elected officials, governmental agencies, organizations, academia, the media and general public that minority and low-income communities bear a disproportionate share of adverse environmental impacts and hazards.⁸ As early as 1987, activists had called on the White House to issue an Executive Order on Environmental Justice.⁹ In 1994, President Clinton responded to the growing movement's call for Executive leadership.¹⁰

4.3.5.1 The Environmental Justice Executive Order of 1994

In response to the growing environmental justice movement and the increasing acknowledgment that minority and low-income communities bear a disproportionate share of the siting and permitting of facilities and projects with adverse environmental and health effects, President Clinton issued Executive Order 12898 ("E.O. 12898") in 1994: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. Executive Order 12898 called on federal agencies to take environmental justice issues, and the potential that federal agency actions may have significant, negative environmental and health impacts on low-income and minority communities, into account in all agency decision making, including public comment and review procedures. E.O. 12898, 59 Fed. Reg. 7629 § 1-1 (1994). The Order provided that "to the greatest extent practicable and permitted by law,...each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations..." Id. at § 1-101.

Executive Order 12898 also directed federal agencies to develop internal standards and procedures that facilitate the implementation of the Order's directives into agency decision making processes. In addition, federal agencies were directed to develop an Environmental Justice Strategy that identified and addressed any disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations. In order to fulfill these requirements, the Department of Transportation ("DOT") issued

⁷ See Robert Collin, *Environmental Equity: A Law and Planning Approach to Environmental Racism*, 11 Va. Envtl. L. J. 495, 518-535 (1992); Rodger Field, *Siting, Justice, and the Environmental Laws*, 16 N. Il. U. L. Rev. 639, 649-653 (1996); Willie Gunn, *From Landfill to the Other Side of the Tracks: Developing Empowerment Strategies to Alleviate Environmental Injustice*, 22 Oh. N. U. L. Rev. 1227, 1271-1287 (1996); Willie Hernandez, *Environmental Justice: Looking Beyond Executive Order No. 12898*, 14 J. of Envtl. L. 181, 197-99 (1996).

⁸ See Barry Hill, *Chester, PA – Was it a Classic Example of Environmental Injustice?*, 23 Vt. L. Rev. 479, 483-89 (1999); Stephen Johnson, *NEPA and SEPA's in the Quest for Environmental Justice*, 30 Loyola of L.A. L. Rev., 565, 565-66, n. 1-4; Field, *supra*, 16 N. Il. U. L. Rev. at 639-643; Gunn, *supra*, Oh. N. U. L. Rev. at 1227-1250; Hernandez, *supra*, 14 J. of Envtl. L. at 181-197.

⁹ See Gunn, *supra*, Oh. N. U. L. Rev. at 1251-52, n. 165.

¹⁰ It was clear to environmental justice activists that the new Administration would be receptive to renewed calls for an environmental justice Executive Order. Prior to becoming Vice President, Senator Al Gore had sponsored Senate Bill 2806, the Environmental Justice Act of 1992, 102 Cong., 2nd Sess. Gunn, *supra*, Oh. N. U. L. Rev. at 1252, n.168. Furthermore, newly appointed Administrator Carol Browner named environmental justice one of the EPA's top priorities in 1993. *Id.* at 1252, n. 169.

Order No. 5610.2, Order to Address Environmental Justice in Minority and Low-Income Populations. 62 Fed. Reg. 18377 (1997). Likewise, the Federal Highway Administration (“FHWA”) issued Order No. 6640.23, FHWA Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, in December 1998.

4.3.5.2 Environmental Justice and NEPA: Federal Court’s Review of the Evaluation of Environmental Justice Issues in EISs for Proposed Transportation and Other Federal Projects in Light of E. O. 12898

Although E.O. 12898 did not directly address the use of any specific statutory or regulatory schemes, President Clinton issued a memorandum concurrently with the Order “to underscore [that] certain provisions of existing” civil rights and environmental laws, particularly Title VI of the Civil Rights Act of 1964 and NEPA, “can help ensure that all communities across this Nation live in a safe and healthful environment.” The Presidential memorandum stated that:

Environmental and civil rights statutes provide many opportunities to address environmental hazards in minority communities and low-income communities. Application of these existing statutory provisions is an important part of this Administration’s efforts to prevent those minority communities and low-income communities from being subject to disproportionately high and adverse environmental effects.

With regard to NEPA, the memorandum directed:

[e]ach Federal agency shall analyze the environmental effects, including human health, economic and social effects, of Federal actions, including effects on minority communities and low income communities, when such analysis is required by the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. § 321 et seq..

In December 1997, the Council on Environmental Quality (“CEQ”), in consultation with EPA, issued “guidance to further assist federal agencies with their NEPA procedures so that environmental justice concerns are effectively identified and addressed.” CEQ, *Environmental Justice: Guidance Under the National Environmental Policy Act*, at 1 (Dec. 1997).¹¹ The CEQ’s Guidance directed agencies to evaluate environmental justice issues at each and every step of the NEPA process, as appropriate, whenever such issues arise. *Id.* at 8. Furthermore, “environmental justice issues encompass a broad range of impacts covered by NEPA, including impacts on the natural or physical environment and interrelated social, cultural and economic effects.” *Id.* Under the CEQ regulations implementing NEPA, direct, indirect and cumulative “effects” and “impacts” are defined to “include “ecological...aesthetic, historic, cultural, economic, social or health” effects. *Id.* at n. 23, 40 C.F.R. 1508.8.

¹¹ As part of the Executive Office of the President, the CEQ “has oversight of the federal government’s compliance with Executive Order 12898 and NEPA.” CEQ, *Environmental Justice: Guidance Under NEPA*, at 1. As Chair of the Interagency Working Group (IWG) on Environmental Justice (established by E.O. 12898 to assist agencies in developing environmental justice strategies), EPA is the lead agency responsible for implementation of the Environmental Justice E.O. of 1994. *Id.* at n. 3. In April 1998, EPA also issued its own *Guidance: U.S. EPA, Final Guidance For Incorporating Environmental Justice Concerns in EPA’s NEPA Analysis* (April 1998) See (<http://www.epa.gov/oeca/ofa/ejepa.html>).

The CEQ's 1997 Guidance for environmental justice analysis under NEPA stresses the fact that E.O. 12898 "does not change the prevailing legal thresholds and statutory interpretations under NEPA and existing case law." CEQ, *Environmental Justice: Guidance under NEPA*, at 9. Thus, any adverse environmental, health, social, cultural, or economic impacts, be they direct, indirect or cumulative, on minority or low-income communities must be "significant" to warrant evaluation within an EIS or other document required by NEPA. Although the CEQ 1997 Guidance emphasizes that E.O. 12898 focuses agency attention on evaluation of adverse environmental and health effects of proposed projects that disproportionately impact minority and low-income populations, it acknowledges that:

Under NEPA, the identification of a disproportionately high and adverse human health or environmental effect on a low-income population, minority population, or Indian tribe does not preclude a proposed action from going forward, nor does it necessarily compel a conclusion that a proposed action is environmentally unsatisfactory. Rather, the identification of such effect should heighten agency attention to alternatives (including alternative sites), mitigation strategies, monitoring needs, and preferences expressed by the affected community or population.

CEQ *Environmental Justice Guidance under NEPA*, at 9-10. Nevertheless:

When [an] agency has identified a disproportionately high and adverse human health or environmental effect on low-income populations, minority populations, or Indian tribes from either the proposed action or alternatives, the distribution as well as the magnitude of the disproportionate impacts in these communities should be a factor in determining the environmentally preferable alternative. In weighing this factor, the agency should consider the views it has received from the affected communities, and the magnitude of environmental impacts associated with alternatives that have a disproportionate and adverse effect on low-income populations, minority populations, or Indian tribes.

Id. at 15. In Appendix A, the CEQ Guidance noted that impacts on low-income and minority communities are "disproportionately high and adverse" when "they are above generally accepted norms," where "the risk or rate of hazard exposure...appreciably exceeds or is likely to exceed the risk or rate to the general population or other appropriate comparison group," or results in "cumulative or multiple adverse exposures from environmental hazards." CEQ Guidance, Appendix A: Guidance for Federal Agencies on Key Terms in Executive Order 12898. "Minority populations" include any area where: "(a) the minority population of the affected area exceeds 50 percent, or (b) the minority population percentage of the affected area is meaningfully greater than...[that of] the general population or other appropriate unit of geographical analysis."

In its final Guidance for addressing environmental justice in NEPA, EPA noted that by focusing on low-income and minority populations in NEPA processes and evaluations:

Environmental justice concerns may lead to more focused analysis, identifying significant effects that may otherwise have been diluted by examination of a larger population or area. Environmental justice concerns should always trigger the serious evaluation of alternatives as well as mitigation options.

Final Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analysis, April 1998, at p. 7.

Although the Presidential Memorandum accompanying E.O. 12898, along with the CEQ Guidance, direct agencies to incorporate environmental justice analysis in all NEPA processes and documents, the Order and memorandum do not impose upon federal agencies any new duty or obligation to assure that proposed projects avoid any and all adverse impacts on minority and low-income communities.

4.3.5.3 Environmental Justice E.O. 12898 and Cause of Action for Judicial Review or Enforcement

Both the Environmental Justice E.O. of 1994 and the accompanying Presidential Memorandum, by their terms, specifically state that they do not create any right to judicial review for compliance or noncompliance. Section 6-609 of E.O. 12898, Judicial Review, provides that:

This order is intended only to improve the internal management of the executive branch and is not intended to, nor does it create any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity by a party against the United States, its agencies, its officers, or any person. This order shall not be construed to create any right to judicial review involving the compliance or noncompliance of the United States, its agencies, its officers, or any other person with this order.

E.O. No. 12898, 59 Fed. Reg. 7629, § 6-609 (1994).¹² Furthermore, the CEQ's 1997 Guidance for environmental justice analysis under NEPA stresses that it merely "interprets NEPA as implemented through the CEQ regulations in light of Executive Order 12898" and as such does not create any substantive or procedural rights, benefits or trust obligations enforceable in any court. Accordingly, orders, guidelines or strategies issued by any federal agency regarding the implementation of E. O. 12898 are likewise not subject to judicial review or enforcement. For instance, the Department of Transportation Order No. 5610.2, Order to Address Environmental Justice in Minority and Low-Income Populations, states that it is "an internal directive to the various components of DOT and does not create any right to judicial review for compliance or noncompliance." 62 Fed. Reg. 18377, 18378 (1997).

It is important to note that President Clinton could have made the environmental justice provisions and directives of E.O. 12898 subject to enforcement upon judicial review. In general, Executive Orders that are issued pursuant to statutory mandate or delegation of authority from Congress have the same force and effect of law as federal statutes, preempt inconsistent state law, and are enforceable by judicial review so long as the language and terms of the Order make clear an intent to create a private cause of action for judicial review. See *Independent Meat Packers Assoc. v. Butz*, 526 F.2d 228 (8th Cir. 1975), cert. den., 424 U.S. 966 (1976).

¹² The Presidential Memorandum accompanying E.O. 12898 contained identical language asserting that the memo and its directive regarding Title VI and NEPA "is not intended to, nor does it create, any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity by a party against the United States, its agencies, its officers or any person."

Executive Orders, like E.O. 12898, that do not carry the force of statutory law and are not subject to judicial review, however, and:

are merely tools to implement the personal policies of the President. These Orders do not legally bind agencies and are enforceable only at the President's discretion. Individuals therefore cannot assert a cause of action to enforce the order's requirements.

Steven Osterow, *Enforcing Executive Orders: Judicial Review of Agency Action Under the Administrative Procedure Act*, 55 Geo. Wash. L. Rev. 659, 660, n.7 (1987).

Several recent federal court cases have dismissed challenges to transportation projects on the grounds that NEPA documents failed to or inadequately considered the project's adverse impacts on low-income and/or minority communities.

In *Morongo Band of Mission Indians v. Federal Aviation Admin.*, 161 F.3d 569, 575 (9th Cir. 1998) the Morongo Indian Tribe challenged an airport "arrival enhancement project" (which was part of a larger airport expansion project) proposed by the Federal Aviation Administration ("FAA") that involved new flight paths over portions of the tribe's reservation. The tribe claimed that the FAA not only failed to adequately evaluate the direct aircraft noise impacts and the indirect, growth-inducing effects of the project in violation of NEPA, but failed to consider the disparate effects such impacts would have on Native Americans residing on the Reservation, in violation of the Environmental Justice E.O. of 1994 and the DOT Environmental Justice Order of 1997. The court failed to reach the merits of either of the tribe's environmental justice claims, noting that no private cause of action for judicial review was provided by E.O. 12898 ("this order shall not be construed to create any right to judicial review involving the compliance or noncompliance of the United States, its agencies, its officers, or any other person with this order." 59 Fed. Reg. 7629, § 6-609).

Likewise, in an unreported decision,¹³ *New Valley Greens v. U.S. Dept. of Transportation*, 1996 U.S. Dist. LEXIS 16547, the court refused to rule on the merits of the plaintiff's environmental justice challenges to the construction of a section of a "smart highway" proposed by the Virginia DOT ("VA DOT") between Blackburg and Roanoke, Virginia. In addition to challenging the adequacy of the project's FEIS and a decision not to prepare a SEIS, plaintiffs alleged unsupported conclusion regarding impacts on low-income and minority population. As part of the challenge of the defendant's decision not to supplement the FEIS, the plaintiffs claimed that the unsupported and unexplained, conclusive statement in the Addendum to the FEIS that "there will be no disproportionate impacts to minority or low-income families" is wholly inadequate in violation of NEPA and the environmental Justice E.O. of 1994. The court refused to reach the merits of this claim because E.O. 12898 creates no private cause of action for enforcement through judicial review. The court stated and held that:

In asserting that defendants have violated NEPA by failing to consider disproportionate impacts on minority and low-income populations, plaintiffs are attempting to do indirectly under NEPA what cannot be done directly under E.O. 12898, issued in 1994 [which] did not

¹³ Unreported decisions (including opinions published only on electronic databases such as LEXIS and Westlaw) are not official and have no binding precedential value, although they may be cited as persuasive authority.

exist at the time the FEIS was completed. Thus, defendants could not be held to have violated NEPA for failing to consider disproportionate impacts on minority and low-income populations in the FEIS. The only question, then, is whether the defendants can be held to be in violation of NEPA for failing to consider E.O. 12898 in the Addendum. Because the Order denies a private rights of action, plaintiffs may not use the courts to force defendants to comply with the Order's commands. Thus, assuming *arguendo*, that defendants have indeed failed to consider adequately E.O. 12898 in the Addendum, the plaintiffs have no standing to enforce compliance.

Id., at 1655.

Citizens About Jet Noise, Inc. v. Dalton, 48 F. Supp. 2d 582 (1999), involved a challenge to the relocation of aircraft to a Naval air station in Virginia as part of a larger base closure in Florida. Among other challenges, the plaintiffs argued that the FEIS for the aircraft relocation was inadequate because it failed to consider reasonable alternatives and contained a flawed environmental justice analysis. The court noted that, "in accordance with Executive Order 12898, the Navy conducted an environmental justice analysis of the [alternatives] and included this analysis in the FEIS." *Id.* at 604. The plaintiff's claimed that this environmental justice analysis was fatally flawed because it used different population statistics than those used for evaluation of noise impacts. The court refused to review the merits of the adequacy of the FEIS's environmental justice analysis because "executive Order 12898 specifically states that any agency actions taken pursuant to the provisions of the Order are not subject to judicial review," citing *Morongo*, 161 F.3d at 575 and E.O. 12898, 59 Fed. Reg. 7629, § 6-609 ("this order shall not be construed to create any right to judicial review involving the compliance or noncompliance of the United States, its agencies, its officers, or any other person with this order.").

The *Dalton* court took a further step by opining in *dicta*¹⁴ that "NEPA does not require an environmental justice analysis." *Id.* (emphasis added). Although the Presidential Memorandum accompanying E.O. 12892, the CEQ Guidance for implementing E.O. 12898 under NEPA, and the Orders and Strategies of DOT, FHWA and other agencies all direct that environmental justice issues shall be included in EISs and other NEPA documents, the *Dalton* court's statement that no environmental justice analysis is required by NEPA is accurate only in the sense that the directives in E.O. 12898 (and its accompanying Memorandum) do not have the binding force and effect of statutory law, and, as such create no private right of action and are not enforceable by judicial review.

However, because E.O. 12898 does not create any new rights, but merely emphasizes the already existing obligations under NEPA that adverse environmental impacts – including negative socioeconomic and health effects – be identified and evaluated, minority and low-income community groups could arguably convince a federal court that an EIS or EA that completely or inadequately identified or evaluated significant adverse impacts of a transportation project on such a community violated NEPA solely on NEPA's own terms and without regard to E.O. 12898. The new emphasis

¹⁴ *Dicta* refers to legal conclusions or positions on legal questions stated by a court in a published decision that are not binding holdings because they do not relate to matters at controversy properly before the court for its judgment. Legal positions or opinions stated in *dicta*, however, are often cited as persuasive authority by other courts and, of course, indicate a position the court may take on an issue at a later date.

and focus placed upon environmental justice issues in the NEPA process by E.O. 12898, DOT Order No. 5610.2, and FHWA Order No. 6640.23, make it likely that transportation projects with adverse effects on minority and low-income communities will be challenged as violating the terms of NEPA without regard to the fact that on E.O. 12898 provides no private cause of action. Such challenges may have a greater chance of success if plaintiffs can establish that DOT or FHWA failed to adequately follow their own environmental justice orders, strategies and policies for identifying and analyzing adverse impacts on minority and low income communities, particularly with regard to citizen participation and community input at all stages of the NEPA process.

Although the Executive Order does not provide for judicial review, plaintiffs may seek review by challenging a transportation project's disparate adverse impacts as discriminatory such that the NEPA process violated Title VI of the Civil Rights Act of 1964. It is likely that this will be the major mechanism for review and enforcement of agency policies relating to Environmental Justice in the future.

4.4 Other Legal Standards Which Often Apply to Indirect Effects Cases

4.4.1 Non-federal Indirect Effects and the Small Handles Problem

4.4.1.1 Major Federal Actions

NEPA requires preparation of an EIS for all "major federal actions significantly affecting the quality of the human environment." 42 U.S.C. § 4332(2)(C)(I). The question of whether an action is "major" and thus triggers NEPA is rarely subject of controversy in case law. "Any substantial commitment of resources, whether monetary or otherwise," is enough to qualify a transportation project as "major." The CEQ regulations define "federal actions" as those which are subject to federal control and responsibility, including "projects and programs entirely or partly financed, assisted, conducted, regulated, or approved by federal agencies." 40 C.F.R. § 1508.18(a). Most transportation projects are clearly federal actions.

4.4.1.2 The Small Handles Problem

When a proposed private and/or state action with significant environmental impacts involves minimal or marginal federal agency action the question arises whether the federal agency must prepare a comprehensive EIS that evaluates the environmental impacts of the entire project, not just the smaller piece or pieces involving the federal agency. This dilemma is commonly referred to as the "small handles" problem. See Fitzgerald, *Small Handles, Big Impacts: When Should NEPA Require an EIS?*, 23 B.C. Env'tl. Aff. L. Rev. 437, 438 (Winter 1996).

When determining whether a project constitutes a "major federal action," some courts have adopted a "dual approach" by analyzing both: 1) the scope of the federal involvement in the project; and 2) the significance of the project's environmental effects. Under this "dual approach," the federal involvement must be major in order for an EIS to be required for the project. See *Scherr v. Volpe*, 466 F.2d 1027 (7th Cir. 1972); *NAACP v. Medical Center, Inc.*, 584 F.2d 619, 626-27 (3rd Cir. 1978). Other circuits, however, have employed a "unitary approach" by analyzing only the significance of the environmental impact. See *Minnesota Public Interest Research Group v. Butz*, 498 F.2d 1314 (8th

Cir. 1974); *City of Davis*, 521 F.2d at 673. Under the unitary approach, courts reason that any federal project which will have a significant effect on the environment should be considered a major federal action. Courts adopting a unitary approach have emphasized that a dual approach could hold that NEPA does not apply to “minor” federal actions that have significant environmental impacts, thereby defeating one of the primary purposes of NEPA. See Fitzgerald, *Small Handles, Big Impacts*, 23 B.C. Env’tl. Aff. L. Rev. at 445-46. The CEQ regulations have expressly adopted the unitary approach. See 40 CFR §1508.18.

4.4.1.3 Evaluating Whether Federal Involvement is Sufficient to Federalize a Project

The application of a unitary approach would at first glance appear to resolve the small handles problem; the significance of the environmental impact would require a comprehensive EIS even for projects that have marginal or minor federal involvement. See Fitzgerald, *Small Handles, Big Impacts* 23 B.C. Env’tl. Aff. L. Rev. at 448. However, most courts have also inquired whether the federal involvement in a project has been sufficient to “federalize” the whole project. Under this approach, the threshold inquiry is whether the federal involvement is significant enough to the project in its entirety – including the non-federal aspects of the project – so as to “federalize” the entire project. *Id.* One commentator has noted that:

A project is clearly federalized when the non-federal portions of the project require federal action before legally going forward. Although federal action legally authorizing a project is sufficient to federalize a project, such legal authorization is not necessary to federalize a project. Whether a project has been sufficiently ‘federalized’ is less clear, however, when the federal action is not a legal requirement for the project, but the federal agency arguably has de facto control over the fate of a project so that opponents of the project can argue, in good faith, that the project will not go forward without agency approval.

Id. at 449. When determining whether federal involvement is sufficient to “federalize” a project, courts examine the nexus between the federal and non-federal components of the project. *Id.* In evaluating this nexus, some courts have analyzed whether the federal and non-federal components are interdependent or merely complementary.

For example, *Port of Astoria v. Hodel*, 595 F.2d 467, 471-77 (9th Cir. 1979) involved a private corporation’s proposal to construct an aluminum reduction plant. Because a federal agency contracted to supply power to the plant, thus enabling the private project to proceed, the Court of Appeals for the Ninth Circuit held that the private and federal agency actions were interdependent. *Id.* at 477. Since the entire project was therefore “federalized,” a comprehensive EIS was required that evaluated the impacts of both the aluminum plant and the power lines from the federal agency. *Id.*

In another Ninth Circuit case, *Enos v. Marsh*, 769 F.2d 1363 (9th Cir. 1985), the Corps of Engineers proposed a project designed to provide a second deep-water harbor for commercial and industrial use on the island of Oahu. The plaintiffs challenged the EIS, for failing to adequately evaluate the environmental impacts associated with the indirect effects of state-sponsored shoreside facilities, including piers, warehouses, and industrial facilities that would be developed around the harbor. *Id.* at 1371-72 The plaintiffs argued that the state’s shoreside facilities and the federal harbor projects were so functionally interdependent that they constituted a single federal action. The court disagreed, noting that the federal and state projects serve complementary but distinct functions. The

court distinguished cases where certain segments of projects were designated as “state” and others as “federal” projects in an effort to avoid NEPA’s requirements. *Id.*

Two additional factors dissuaded the court from including the state’s activities within a federal NEPA action:

First, the shoreside facilities are completely state-funded. “Where federal funding is not present [the court has] generally been unwilling to impose the NEPA requirement” of filing an EIS. Second, the federal government exercised no control over the planning and development of these facilities. Rather, local officials have been the only relevant decision makers. Lacking both federal funding and federal supervision over the development of the facilities, the construction of the shoreside facilities is not “federal” action for the purposes of NEPA.

Id. at 1372 (citations omitted).

Many transportation projects involving indirect effects will constitute “major federal actions” subject to federal control and responsibility by nature of being “entirely or partly financed, assisted, conducted, regulated, or approved by federal agencies.” 40 C.F.R. § 1508.18(a). In those situations where significant indirect effects stem from non-federal portions of a larger project (such as the state planned shoreside facilities in *Enos*, 769 F.2d at 1371-72), courts analyze the nexus between the federal and non-federal components to determine if they are interdependent, thus “federalizing” the entire project, or merely complementary, in which case the non-federal aspects need not be evaluated in an EIS.

4.4.2 Statute of Limitations

Private actions involving NEPA claims are subject to the six year statute of limitations under the Administrative Procedure Act (“APA”), 28 U.S.C. § 2401(a). *Sierra Club v. Slater*, 120 F.3d 623, 629-30 (6th Cir.1997). Issuance of the Final EIS, or of the record of decision (“ROD”) approving the FEIS, constitutes the final agency action at which time the statute of limitations commences. *Id.* at 630-31. See *Johnson*, 30 Loyola L. Rev. at n. 70 re: NEPA does not include a judicial review provision, but the A.P.A. “creates a right of review for final agency actions under NEPA.” citing *Marsh*, 490 U.S. 360, 375 (1989). “The general federal question jurisdictional statute enables federal district courts to hear those challenges.” 28 U.S.C. § 1331.

4.5 Conclusion

Although it requires that agencies take a “hard look” at all significant environmental impacts, NEPA demands a procedural process, not a substantive result. Agencies are required to analyze all reasonably foreseeable, significant impacts, but need not place environmental concerns above the project’s positive economic development, access, safety or other benefits and goals. NEPA’s focus is on disclosure, discussion and informed decision making. While direct, indirect and cumulative effects must all be evaluated for environmental impact, the focus of the inquiry should be on the significance of any impacts, regardless of type, rather than on classification of and differentiation between primary, secondary or cumulative impacts.

Under the CEQ regulations, which are binding on federal agencies and are given substantial deference by federal courts, determination of the significance of an action requires considerations of both context and intensity. An EIS need not contemplate and evaluate every conceivable indirect impact of a proposed agency action, only those that are “reasonably foreseeable.” Although uncertainty is inherent in an attempt to identify and analyze any future indirect or cumulative effect, agencies may not dodge the required analysis of future impacts by labeling such attempts mere conjecture. Instead, an EIS must engage in “reasonable forecasting” by analyzing all significant impacts that are not remote or highly speculative, but are realistically probable. As such, reasonable foreseeability means that the impact is sufficiently likely to occur that a person of ordinary prudence would take it into account in reaching a decision. An indirect impact is too speculative if it can not be described at the time the EIS is drafted with sufficient specificity to make its inclusion in an EIS useful. An EA or EIS will not violate NEPA so long as an agency acknowledges and evaluates all potential impacts that are significant and are likely enough to be identified and described with sufficient specificity – either by the agency itself or by challengers during the comment process.

Although the arbitrary and capricious standard now applies to every federal court reviewing an agency’s EA and FONSI resulting in a decision not to prepare an EIS, all federal courts review the adequacy of the content of an EIS using a reasonableness standard. Under this “rule of reason” standard, the court must be satisfied that the agency has gone “beyond mere assertions” and has explicated fully its inquiry, analysis and reasoning. Thus, mere listing or cataloging of possible impacts in an EIS will not pass muster under NEPA. However, the few recent indirect effects cases involving transportation projects have not required much more than a descriptive listing. Of course, the extent of detailed analysis reasonably necessary to evaluate secondary impacts depends upon the facts and circumstances of the case. Because judicial opinions do not append the administrative record and only rarely quote key or exemplary language from an EIS’s evaluation of indirect effects, most published opinions provide little, if any, guidance concerning the level of detail required in an agency’s analysis of the secondary impacts of transportation projects.

The relatively small number of indirect effect cases involving transportation projects provide general legal guidance for determining when a project’s growth-inducing or other indirect effects (including the adverse environmental impacts resulting from induced residential and/or commercial growth) are significant and sufficiently probable that they must be analyzed in an EIS. Promotion of the economic benefits resulting from growth-inducing impacts as “selling points” for a proposed transportation project helps establish that the indirect effects are sufficiently probable and describable to be presently evaluated in an EIS before the project advances to a point where it will inevitably go forward and the adverse impacts can not be considered, reversed or significantly mitigated.

No clear standards emerge from the case law regarding the use of local or regional planning documents and studies to support arguments that growth-induced development was already planned, would have occurred anyway, or that indirect effects need not be evaluated in an EIS because existing zoning and other local land use controls prohibit development of the type the project’s challengers argue will be induced. The ability to rely on local plans and land use controls depends, of course, on the particular facts of the case. However, courts will consider local and regional plans and land use controls where strong arguments can be advanced that the controls will be strictly enforced and not easily subjected to variance or amendment by political influence resulting from development pressure caused, indirectly, by the proposed transportation project.

Finally, the increasing focus on environmental justice has led environmental, civil rights and community activists to begin challenging the disparate adverse environmental impacts of federal agency actions on minority and low-income communities. Although President Clinton's 1994 Environmental Justice Executive Order and related orders and strategy directives by U.S. DOT and FHWA, by their terms, do not create a private cause of action for judicial review, it is likely, however, that environmental justice claims will begin to surface more frequently in cumulative and indirect effect challenges to transportation project EISs when brought in conjunction with Title VI challenges.

5.0 LAND USE PRACTICE

5.1 Comprehensive Planning

Pursuant to NCGS Chapter 160A-383, zoning regulations must be made in accordance with a comprehensive plan and designed to address a public purpose such as lessening congestion, secure safety from fire, panic and other dangers, to promote the general health and welfare, to prevent the overcrowding of land and to facilitate the provision of a variety of public services. Zoning regulations must be made with consideration as to the character of the district, suitability of particular uses and a view toward conserving the value of buildings and encouraging the most appropriate land use throughout the city.

Land use control in North Carolina is very similar to comprehensive (synoptic) planning and zoning used widely through much of the United States. Refer to *Municipal Government in North Carolina* (UNC Institute of Government, 1996) for further details.

5.2 Zoning

The enabling legislation granting zoning authority to local governments is addressed at NCGS 160A-381. Counties and municipalities are granted the authority to adopt zoning schemes for the purpose of promoting health, safety, morals or the general welfare of the community. The enabling legislation permits control of both bulk and use on the land, including size and location of buildings, lot size and coverage, permitted uses and dedications.

5.2.1 Planning Agency

In order to exercise the powers conferred in the enabling legislation, a local government must create or designate a planning agency to prepare the text and map of a zoning ordinance, which is then certified to the local legislative body for review and comment either adoption/ rejection or return to the planning agency for revision before final adoption or rejection.

5.2.2 Zoning Board of Adjustment

The local legislative body may appoint a board of adjustment to hear and decide appeals of any order, decision or determination of the administrative officer charged with the enforcement of the zoning ordinance. Appeals of zoning board decisions are made by certiorari proceeding in state superior court.

The ordinance may also provide for the zoning board to permit special or conditional exceptions to the zoning regulations.

5.3 Subdivision of Property

North Carolina enabling legislation provides for the subdivision of land by ordinance within the territorial jurisdiction of each county. A county need adopt subdivision regulations only for the portion of the county regulated by an adopted zoning plan. Areas of the county without zoning are not required to adopt subdivision regulations.

The subdivision control ordinance provides for the orderly development and growth of the county; for the coordination of the development of streets and roads within the proposed subdivision and with other community facilities. The ordinance may require dedication of land for streets, easements or recreation. The ordinance may also provide for a payment in lieu of construction of streets or other dedication, where such funds will be used to serve the occupants of the subdivision. Funds received by the county for this purpose are transferred to the municipality where the development will occur.

6.0 TERMINOLOGY/DEFINITIONS

The NCHRP review study of indirect effects (NCHRP, 1998) noted no consistent definition of indirect effects was used in the 90 EISs studied. This review also notes that the terms “indirect” and “secondary” were essentially used interchangeably across all disciplines in these EISs. The term “induced effects” was typically used and applied to land use or economic impacts. “Cumulative effects” were generally differentiated from “indirect effects” by inclusion of effects from other projects. In several instances the definitions of “cumulative” and “indirect” were found to overlap considerably. The term “primary effects” was used in one EIS to include both “direct effects” and “indirect effects.”

The NCHRP also reported a strong positive correlation between the existence of a local land use plan and the identification of indirect effects, especially as related to cultural resource effects. This may be due to the Section 106 requirements for evaluating indirect and cumulative effects to cultural resources in the legislation. The number of indirect effects, especially wetlands and ecological effects, also tended to be higher in projects outside of Metropolitan Statistical Areas (MSAs).

According to CEQ’s *Forty Most Asked Questions*, “reasonably foreseeable” includes uncertainty; however, the effects, although uncertain, must also be “probable.” The courts have supported this definition. Therefore, considering that “indirect effects” are “probable” eliminates

effects that are “possible” from consideration. The use of “probable” also helps to distinguish indirect effects from direct effects. Direct effects appear to be inevitable results of an action on the project’s affected environment, while indirect effects are not inevitable but probable. It is important to note that distinguishing between “direct” and “indirect” effects is not as important as whether the effect is significant or not (FHWA, 1992).

TYPES OF EFFECTS

Type of Effect	Direct	Indirect	Cumulative
Nature of Effect	Typical/ Inevitable/ Predictable	Reasonably Foreseeable/Probable	Reasonably Foreseeable/Probable
Cause of Effect	Project	Project’s Direct and Indirect Effects	Project’s Direct and Indirect Effects and Effect of Other Activities
Timing of Effect	Project Construction and Implementation	At Some Future Time than Direct Effect	At Time of Project Construction or in the Future
Location of Effect	At the Project Location	Within Boundaries of Systems Affected by the Project	Within Boundaries of Systems Affected by the Project

6.1 Identification of Indirect Effects

Although definitions of indirect effects vary widely between agencies in documents other than regulations, there is some consistency in the examples given to support these definitions. For example, the FAA, the FHWA, and the FTA have all used socioeconomic changes to illustrate indirect effects. A typical case comes from the FTA, which discusses indirect impacts on housing demand, which can lead to higher rents, thus driving out poorer tenants and changing business patterns.

EXAMPLES OF INDIRECT OR SECONDARY EFFECTS BY VARIOUS AGENCIES

Agency	Source Document	Example
Federal Highway Administration (FHWA)	Position Paper: <i>Secondary and Cumulative Impact Assessment in the Highway Project Development Process</i> , FHWA, April 1992.	Changes in land use, water quality, economic vitality and population density; negative impacts on endangered species; effects on the ability of existing environmental protection measures to absorb an increased load (e.g., water treatment plant must work harder because of more pollutants due to project). <i>secondary and induced</i>
	<i>Guidance for Preparing and Processing Environmental and Section 4(f) Documents</i> , T 6640.8A, 1987.	Any land use activities that can be considered secondary, including social, economic and environmental. <i>secondary</i>
Federal Transit Administration (FTA)	<i>Procedures and Technical Methods for Transit Project Planning</i> , September 1986.	Increased congestion resulting from development; impact on parking and highway traffic; increased demand for housing near a rail station could have the effect of raising rents and driving out poorer tenants; availability of commercial space could be affected by changes in residence patterns; impaired access to buildings, parks, transit delays, etc., all due to construction. <i>secondary development</i>
	U.S. Department of Transportation (U.S. DOT), Urban Mass Transit Administration Circular, UMTA C 5620.1, <i>Guidelines for Preparing Environmental Assessments</i> , October 16, 1979.	Impacts of secondary development on community development patterns; changes in local infrastructure; changes in local socioeconomic characteristics. <i>secondary development</i>
Federal Aviation Administration (FAA)	<i>Order 5050.4A Airport Environmental Handbook</i> , U.S. DOT, FAA, October 8, 1985.	Shifts in patterns of population movement and growth, public service demands, and changes in business and economic activity due to airport development; regional growth and development, spin-off jobs, induced impacts on natural environment. <i>indirect</i>
	<i>Tips for Airport Sponsors and Their Consultants</i> , FAA, Southwest Region, 1993.	Population increases, public service demands (fire and police), and changes in economic activity due to operation of airport. <i>indirect</i>
	<i>Estimating the Regional Economic Significance of Airports</i> , U.S. DOT, FAA, pp. 92-96, September 1992.	Off-site economic activities attributable to the airport, such as travel agency services, hotels, restaurants, retail establishments. <i>indirect</i>

U.S. Fish and Wildlife Service (USFWS)	USFWS, <i>NEPA Handbook</i> , Release 30-4, September 1983.	Vegetation management causing a change in plant species which can result in a change in grazing patterns and animal population; changes in native fish stock due to artificial fish stocking which increases food demand (by predators) in that stream. <i>final ultimate change</i>
U.S. Environmental Protection Agency (U.S. EPA)	U.S. EPA Dredge or Fill Regulations, 404(b)(1) Guidelines, Section 230.21(b).	For an ecosystem: fluctuating water levels in an impoundment and downstream associated with the operation of a dam, septic tank leaking and surface runoff from residential or commercial developments on fill, and leachate and runoff from a sanitary landfill located in waters of the United States. <i>secondary</i>

*Source: NCHRP 1996, (Table 1, Page 15)

II. INDIRECT AND CUMULATIVE IMPACTS ASSESSMENT IN NORTH CAROLINA: THE STATE OF THE PRACTICE

SECTION II

INDIRECT AND CUMULATIVE IMPACTS ASSESSMENT IN NORTH CAROLINA: THE STATE OF THE PRACTICE

1.0 Objective

The objective of this section is to identify the state of the practice of indirect and cumulative impact assessment in North Carolina and to compare the North Carolina practice to the practices in other states. A comparison to other states' practices and the requirements leads to identification of gaps in practice.

2.0 Current Practice in North Carolina

2.1 NEPA

Under the NEPA umbrella there are three levels of environmental studies, namely the Environmental Impact Statement (EIS), Environmental Assessment (EA) and Categorical Exclusion (CE). Categorical Exclusion level studies are for actions which “. . . *do not induce indirect significant impacts to planned growth or land use. . .*” or “. . . *do not otherwise, either individually or cumulatively, have any significant impacts*” (23 C.F.R. § 771.117). Therefore, CEs by definition do not have significant indirect and cumulative effects.

A review of over 20 recent EA and EIS studies for NCDOT projects shows indirect and cumulative effects assessments to be lacking in most projects reviewed. Typically indirect and cumulative effects analysis were historically not included as an issue or a contract item when projects were scoped and negotiated. NEPA studies conducted in-house by NCDOT were also found to typically not address indirect and cumulative effects.

Assessment of direct effects is the primary focus of the current practice by NCDOT for compliance with NEPA. This is due to direct effects being easier to measure and therefore assess. Indirect and cumulative effects have usually not addressed formally in the documents although they (one or two specific issues) may be identified briefly.

2.2 SEPA

Proposed state and federal agency projects in North Carolina are submitted for state review through the state clearinghouse in the Department of Administration. Those proposed projects submitted under SEPA comprise about 300 projects annually (Personal Communication, Chrys Baggett, NC Department of Administration). These projects include those related to: water and wastewater, prisons, university facilities and buildings, as well as transportation projects.

Under North Carolina law, each agency may establish specific criteria (1 NCAC 25.0301(a)),

through the standard rule making procedures, regarding the minimum thresholds necessary to trigger a requirement for a SEPA environmental study of a proposed action. Non-Major Actions are those federal and state funded actions which have a minimal potential for adverse environmental impacts. State funded non-Major Actions, according to the minimum criteria, do not require preparation of a state environmental document. Major Actions are those actions of considerable importance, involving a substantial commitment of time and resources, which may have an adverse impact to the natural or cultural environment (NCDOT, 1993). Unless a SEPA document is prepared under a lead agency designation, the project will have to meet the non-major action criteria of other state agencies to meet the requirements of SEPA without preparing a document.

State funded projects which meet the minimum criteria threshold are not exempt from the regulatory requirements enforced by other state and federal agencies, such as the US Army Corps of Engineers and the Department of Environment and Natural Resources. It is the responsibility of the agency sponsoring the project to obtain all required permits and licenses, and to coordinate with other agencies during the project development process (NCDOT, 1993).

3.0 Current Practice in Other States

Practices by DOTs in other states regarding indirect and cumulative effects assessment were reviewed to assess what might be learned from their experiences. The following discussions highlight the current practices of the DOTs in Florida (FDOT), Wisconsin (WisDOT) and Illinois (IL DOT).

3.1 Florida

Historically, FDOT has taken the position that the Department of Transportation is not the growth management agency of the state. Indirect and cumulative effects therefore, are considered as factors which must be examined as part of the local jurisdictions and MPOs comprehensive planning process. However, FDOT does have a requirement that their projects and plans must be consistent with the comprehensive plans approved by the local governmental units.

Environmental agencies have not been satisfied with this local approach, however, as changes in local personnel (elected and staff level), regulations/zoning, and political priorities have resulted in failure to support the long-term environmental commitments which were made. This has resulted in a loss of credibility with the agencies and difficulty on subsequent FDOT projects (Personal Communication, Gary Evink, FDOT).

In the late 1990s the Governor's office put together a Working Group, which included all state and federal agencies, to deal with growth management issues and their implications. A study on "*Secondary and Cumulative Environmental Impacts of Transportation Projects*" by the Florida Atlantic University/Florida International University (FAU/FIU) Joint Center for Environmental and Urban Problems (FAU/FIU, 1998) for the FDOT helped identify specific issues and made recommendations which were considered by the Working Group. The Working Group settled on an early environmental screening approach in the Metropolitan Planning Organization (MPO) transportation systems planning process. The Comprehensive Plans developed would include any environmental commitments made at the local level. As an integral part of these plans, the Working

Group believed that the environmental commitments would be less likely to be overlooked by local governmental units. Thirteen screening elements were developed to help identify potential indirect and cumulative effects issues.

This approach allows the more broad scale indirect and cumulative effects issues to be dealt with at the earlier, comprehensive planning stage. FDOT then is able to focus on dealing with the natural resource issues more directly related to their project, such as off-site effects of blocked or enhanced drainage, habitat fragmentation/maintenance of wildlife corridors, etc. The Development Regional Impact (DRI) process remains very controversial in Florida, however, as citizens groups feel it usurps local control, while environmental groups feel it does not go far enough to protect the environment.

Currently, FDOT is also involved with the FHWA in streamlining the environmental assessment process. This streamlining can be expected to further complicate the indirect and cumulative effects assessment process.

3.2 Wisconsin

Wisconsin DOT (WisDOT) has developed a technical reference guidance document for addressing indirect and cumulative effects for project-induced land development (WisDOT, 1996). Their guidance provides a seven-step analysis framework for conducting indirect and cumulative effects analysis, provides some background and reference information, and provides more detailed information on specific analysis techniques. The guidance does not, however, specifically describe how an indirect and cumulative effects analysis should be conducted. The seven-steps are:

- Ø Define the project study area,
- Ū Analyze the existing patterns and trends for land use and development,
- Ū Analyze the extent of land use planning and regulation,
- Ū Understand the type of transportation project,
- Ū Assess the potential for project-induced land development,
- Ÿ Assess potential consequences to the human environment, and
- Ɔ Describe tools to manage land development.

These seven-steps do not need to be undertaken sequentially. Steps Ø and Ū need to be pursued early in the process because they define the area, time and issues for assessment in steps Ū and Ū. However, data collected in steps Ū and Ū could change the initial conclusions of the other steps.

As part of the seven-step process, WisDOT has developed, a screening worksheet which functions as a checklist. The checklist also allows appropriate details to be provided. WisDOT is using this screening worksheet to direct projects to different levels of NEPA analysis. They currently recognize four levels of projects. WisDOT is also undertaking their projects as if they were all federally funded and therefore requiring the appropriate level of NEPA study and assessment. In practice, WisDOT feels that they will be preparing more EIS level studies than they have in the past.

The WisDOT guidance has been tried on only a few non-controversial EIS projects, but the Environmental Protection Agency (EPA) has accepted the process proposed by WisDOT (Personal Communication, Susan Fox, WisDOT).

WisDOT is also working with FHWA to streamline the environmental assessment process and is experimenting with using their completed screening worksheets as a major component of the EIS document itself. WisDOT is also working with EPA to develop a computer model for indirect and cumulative effects assessment.

3.3 Illinois

The Illinois DOT (IL DOT) has recently initiated indirect and cumulative effects assessment as part of the NEPA compliance for their projects. They are requiring that indirect and cumulative effects be addressed in all EIS level studies, but not at the EA level. IL DOT has not sanctioned a specific methodology, but is requiring evaluation of indirect and cumulative project effects related to: water quality, wetlands, threatened & endangered species, flood plains, etc. IL DOT feels that the intent of NEPA and the CEQ regulations is directed at indirect and cumulative effects to natural resources rather than to social/economic and other resources.

IL DOT is also documenting their environmental analyses of indirect and cumulative effects as a separate chapter in the NEPA documentation rather than including it as part of the chapter on environmental consequences. (Personal Communication, Barbara Stevens, IL DOT).

4.0 Assessment Needs in North Carolina

Initial review of NEPA practices in North Carolina and other states regarding “gaps” in the practice resulted in the identification of three categories of needs, namely Technical, Procedural, and Policy. Note that there is some overlap with some needs falling under more than one category.

4.1 Technical Needs

- Standardized terminology and definitions statewide as per regulations and policy.
- Assessment of indirect and cumulative effects on a broad scale to assist in major-investment decision making.
- Training NCDOT and review agencies’ staffs about indirect and cumulative effects requirements, methodology and responsibilities.

4.2 Procedural Needs

- Develop MOAs with agencies regarding indirect and cumulative effects assessment and the criteria that agencies will use to review environmental documents.
- Review of indirect and cumulative effects should acknowledge the potential uniqueness of each project and be flexible to accommodate differing approaches and detail.

4.3 Policy Needs

- Coordinate with agencies and public to ensure all significant potential indirect and cumulative effects are assessed during the project study.
- Do the NEPA/SEPA and CEQ regulations allow indirect and cumulative effects to be addressed at comprehensive planning stage, unrelated to specific projects? Is comprehensive planning adequate throughout the state to allow indirect and cumulative effects to be considered earlier in the comprehensive planning process?
- Agencies need to recognize that because control of some issues, such as land use, is beyond the mission and jurisdiction of the sponsoring agency (i.e., NCDOT), DOT can not mitigate such issues.

4.4 Other issues and needs

4.4.1 Environmental Impact Statements

- EIS level studies require identification and assessment of significant indirect and cumulative effects as part of environmental documentation.
- Indirect and cumulative effects should be included with direct effects during project scoping with agencies and the public.

4.4.2 Environmental Assessments

- EA level studies require scoping at an early stage to allow for the identification of potential indirect and cumulative effects. To end the environmental document process with a FONSI, the FONSI should include a determination that the project will not result in a potential for “significant” indirect or cumulative effects.
- Indirect and cumulative effects should be included with direct effects during project scoping with agencies and the public.

4.4.3 Categorical Exclusions or Non-Major Actions Under SEPA

- CE level projects will not be included as projects contributing either individually or cumulatively to significant effects.

4.4.4 Mitigation

- Avoidance or mitigation for indirect and cumulative effects must be assessed when the indirect and cumulative effects will be “significant.”

5.0 Lessons Learned

The FDOT and NCDOT experiences with indirect and cumulative effects assessment on NEPA projects show that problems arise when permitting agencies rely on environmental commitments from non-DOT governmental agencies to mitigate or avoid “significant” indirect or cumulative effects (i.e., counties, municipalities). Commitments have not been honored as local priorities change.

Overall, it is probably too soon to assess success of the approaches to indirect and cumulative effects being tried by the Florida, Wisconsin and Illinois DOTs.

III. NCDOT GUIDANCE ON INDIRECT AND CUMULATIVE EFFECTS ASSESSMENT UNDER NEPA/SEPA IN NORTH CAROLINA

SECTION III

NCDOT GUIDANCE ON INDIRECT AND CUMULATIVE EFFECTS ASSESSMENT UNDER NEPA/SEPA IN NORTH CAROLINA

1.0 PURPOSE OF THIS GUIDANCE

The general purpose of this guidance is to provide NEPA/SEPA practitioners in these agencies with a tool to help in the identification, analysis, and assessment of indirect and cumulative effects as part of the NEPA and/or SEPA assessment processes conducted by NCDOT. This guidance is also intended to help review agencies understand NCDOT's assessment of indirect and cumulative effects under NEPA/SEPA. Specifically, this guidance on indirect and cumulative effects is intended to meet the following objectives:

- < Describe the terminology related specifically to indirect and cumulative effects assessment as defined by the regulations and clarified by the courts.
- < Apply the existing case law regarding indirect and cumulative effects assessment to interpretations of terms and applicable practices under NEPA/SEPA.
- < Provide direction on project scoping issues and their implications for addressing indirect and cumulative effects.
- < Provide direction on identification and evaluation of project-induced growth effects.
- < Suggest various methodologies and techniques which may be considered when undertaking indirect and cumulative effects assessment.
- < Describe a framework for incorporating indirect and cumulative effects in NEPA/SEPA documents, e.g., environmental assessment or environmental impact statements, as well as in the planning and other activities which precede the documents.

This guidance is not binding and can not be cited as the NCDOT interpretation of federal or state statutes or rules and regulations.

2.0 STATUTES AND REGULATIONS

Numerous Federal and North Carolina statutes and regulations are relevant to indirect/cumulative effects assessment. These statutes and regulations are detailed in Section I and include:

- National Environmental Policy Act (NEPA),
- Council on Environmental Quality(CEQ) regulations,
- North Carolina Environmental Policy Act (SEPA), and
- elements of the North Carolina Administrative Code.

3.0 TERMINOLOGY

This section contains key terms used in indirect and cumulative impact assessment. Definitions that are directly from the regulations or interpreted from the courts are referenced.

Direct Effects are those effects that “. . . are caused by the action and occur at the same time and place.” (CEQ 1986, 40 CFR §1508.8(a)).

Indirect Effects are those effects that “. . . are caused by the action and are later in time and farther removed in distance, but are still reasonably foreseeable.” Indirect effects “may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.” (CEQ 1986, 40 CFR §1508.8(b)). The terms effects and impacts are used synonymously in the CEQ regulations (see in 40 CFR §1508.8(b)).

There are three main forms of indirect effects (NCHRP Report 403 Guidance for Estimating the Indirect Effects of Proposed Transportation Projects):

Encroachment-Alteration Effects - alteration of the behavior and functioning of the affected environment caused by project encroachment (physical, chemical, or biological) on the environment

Induced Growth Effects - changes in the intensity of the use to which land is put that are caused by the action/project. These changes would not occur if the action/project does not occur. For transportation projects, induced growth is attributed to changes in accessibility caused by the project.

Induced Growth Related Effects - alteration of the behavior and functioning of the affected environment attributable to induced growth.

A project may involve one or more of these types of effects.

Cumulative effects are “environmental impacts resulting from the incremental effects of an activity when added to other past, present and reasonably foreseeable future activities regardless of what entities undertake such actions. Cumulative effects can result from individually minor but collectively significant activities taking place over time and over a broad geographic scale, and can include both direct and indirect impacts.” (see 40 CFR §1508.7).

The Council on Environmental Quality (1998) issued a handbook on cumulative effects that organizes such effects into four types:

- < Type 1 - repeated “additive” effects from a single proposed project.
- < Type 2 - stresses from a single source that interact with receiving data to have an “interactive” (non-linear) net effect.

- < Type 3 - effects arising from multiple sources (projects, point sources, or general effects associated with development) that affect environmental resources additively.
- < Type 4 - effects arising from multiple sources that affect environmental resources in an interactive (i.e., countervailing or synergistic fashion).

Cumulative effects Types 1 and 2 (single action) are generally similar to encroachment - alteration indirect effects. Moreover, cumulative effects types 3 and 4 (multiple actions) are generally similar to effects related to induced growth (which generally relate to other actions in addition to the transportation project).

Reasonably Foreseeable is defined in three court decisions:

“... Reasonably Foreseeable consequences of induced development projects are reasonably foreseeable if the impact is sufficiently likely to occur that a person of ordinary prudence would take it into account in reaching a decision” (*Sierra Club v. Marsh*, 976 F.2d 763, 767 (1st Cir. 1992) (Sierra Club IV)).

“... An environmental impact would be considered ‘too speculative’ for inclusion in an EIS if it cannot be described at the time the EIS is drafted with sufficient specificity to make its consideration useful to a reasonable decision.” (*Dubois v. U.S. Department of Agriculture*, 102 F.3d 1273, 1286 (1st Cir. 1996)).

The 5th Circuit Court noted that “... the CEQ regulations require analysis of direct, indirect and cumulative impacts and held that in this context, the impacts were not limited to those from actual proposals, but must also include impacts from actions which are merely being contemplated (i.e., are not yet ripe for decision). However, the court noted that contemplated actions must be “reasonably foreseeable,” not speculative and not off in the distant future.” (*Fritiofson v. Alexander*, 772 F.2d 1225 (5th Cir. 1985)) Reasonably foreseeable includes uncertainty; however, the effects must also be probable (46 FR 18026, as amended, 51 FR 15618).

Significance is “... the degree to which the proposed action affects public health or safety; the unique geographical characteristics of the surrounding area; the potential for controversy; the possibility of unknown risks; and the potential effect on endangered species.” (40 CFR §1500 - 1508). The 2nd Circuit court developed a two part test for determining the significance of indirect effects involving: 1) degree of change from current land use; and 2) absolute, qualitative adverse environmental impacts of the project. (*Hanly v. Mitchell*, 460 F.2d 640, 647 (2nd Cir. 1972)).

Context is the setting to which an effect occurs, be it over time, distance or area. Context is one of the two factors used to determine whether an effect is significant. (40 CFR §1508.27(a)).

Intensity refers to the severity of an impact. Intensity is one of the two factors used to determine whether an effect is significant. Note that different review agencies may view the severity of impacts quite differently. The following ten factors should be considered in evaluating intensity (40 CFR §1508.27(b)). These factors include:

- (1) “... both beneficial and adverse impacts should be considered.

- (2) . . . the degree to which the proposed action affects public health and safety.
- (3) Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
- (4) The degree to which the effects on the quality of the human environment are likely to be highly controversial.
- (5) The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
- (6) The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
- (7) Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming the action temporary or by breaking it down into small component parts.
- (8) The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.
- (9) The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.
- (10) Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.” (40 CFR 1508.27(b))

Accessibility - The ease of movement between places. As movement becomes less costly--either in terms of money or time--between any two places, accessibility increases. The propensity for interaction between any two places increases as the cost of movement between them decreases. Accessibility is also defined as the attractiveness of a place as an origin (how easy it is to get from there to all other destinations) and as a destination (how easy it is to get to there from all other destinations). Consequently, the structure and capacity of the transportation network affect the level of accessibility within a given area. The accessibility of places has a major impact upon their land values (and hence the use to which the land is put), and the location of a place within the transportation network determines its accessibility.

4.0 SCOPING

Scoping is the key to proper and timely identification and analysis of indirect and cumulative effects. Scoping provides the best opportunity to identify potentially significant issues, set appropriate boundaries for the analysis and identify relevant past, present and future actions. Scoping also allows for the setting of the environmental baseline for which all effects are compared.

Under the federal CEQ regulations (40 CFR Part 1500 - 1508) specific details regarding scoping are provided at §§ 1501.7. As part of this scoping the lead agency shall: “. . . determine the scope and significant issues to be analyzed in depth in the Environmental Impact Statement.” (§§ 1501.7(a)(2); and “. . . identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (§ 1506.3), narrowing the discussions of these issues in the statement to a brief presentation of why they will not have a significant effect on the human environment or providing a reference to their coverage elsewhere.” (§§ 1501.7(a)(3). These issues include those that have indirect and cumulative effects as well as direct effects.

Indirect and cumulative effects should be considered in the scoping process for both NEPA and SEPA documents.

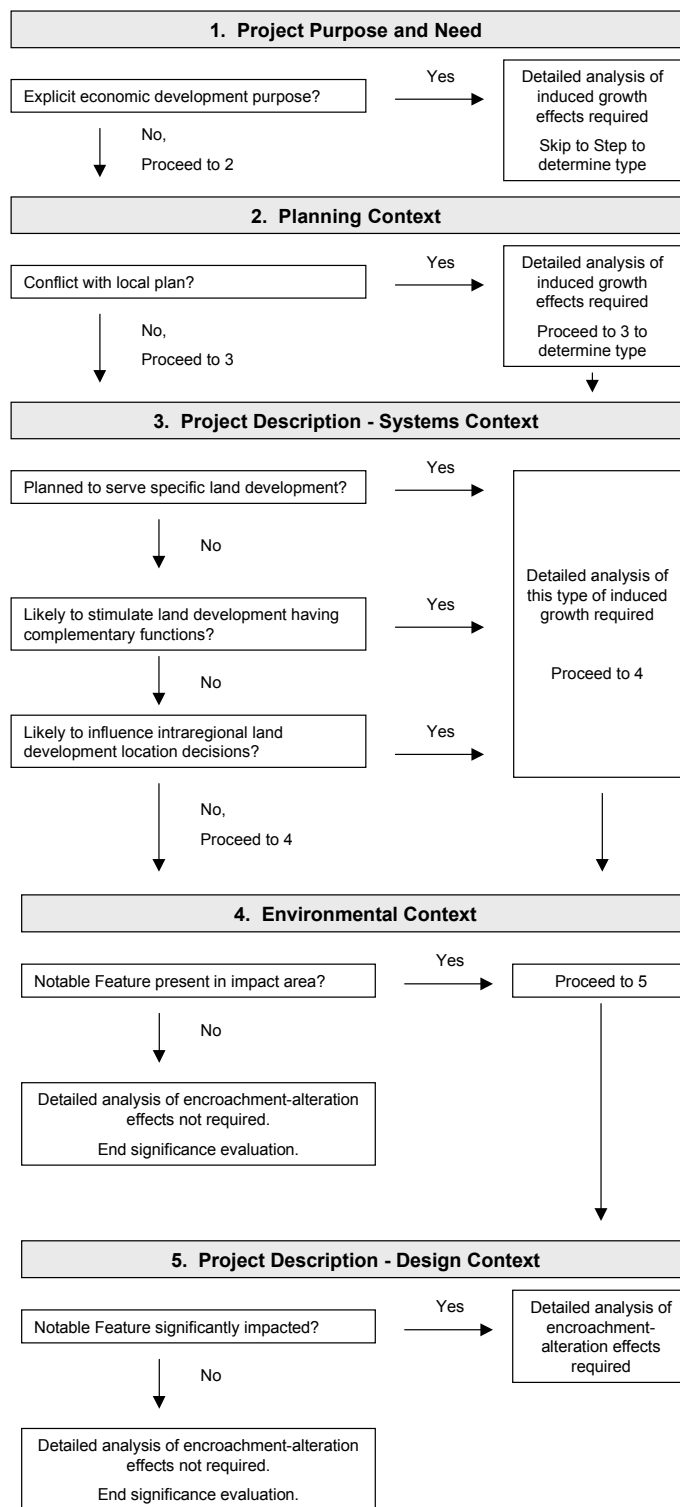
Scoping should generally:

- < identify potentially significant issues and effects for further analysis,
- < identify social, cultural and natural (physical and ecological) resource issues that effect the human environment,
- < identify federal, state and other government, and private actions,
- < identify all past present and future actions.

Figure 1 provides a decision tree for scoping potentially significant indirect and cumulative effects requiring detailed analysis. Tables 1 through 16 have been developed to assist scoping, impact identification, and impact assessment. While it is not necessary to complete the checklists, the checklists can aid data identification and organization. Checklists corresponding to the various scoping steps are referenced by table number.

Scoping of potentially significant indirect and cumulative effects should be timed to coincide with the transportation problem identification step of the generic transportation project planning and development process. The objective is to define goals of the study area, e.g., preservation of community character or a particular ecosystem, in an effort to complement the conventional transportation goals or problems, e.g., traffic safety, inadequate level of service, etc. Better understanding of the interrelationships between an area's transportation and other goals early in the transportation development process can lead to better anticipation of a proposed transportation project's indirect effects issues, e.g., a balance between conflicting needs and goals. Consequently, the social, economic, and environmental goals of the subject area plus the transportation goals can be used as input to forming a project proposal, the next step in the generic transportation project planning and development process.

Figure 1
Decision Tree for Scoping Potentially Significant Indirect and Cumulative Effects
Requiring Detailed Analysis



4.1 Considerations

This section highlights key considerations in scoping the indirect and cumulative impact assessment.

4.1.1 Project Purpose and Need

Economic development (from induced growth) is often cited as justification for proposed transportation projects. Indeed, certain programs, e.g., “development highways,” are authorized by legislation with economic development as their intent. With respect to indirect and cumulative impact assessment, the questions of confidence in and specificity of types of induced growth or secondary impacts as set forth in various court decisions can often be condensed into a single question: if the benefits of induced growth are “selling points” of the project, including those that are legislated, an EA/EIS must consider them. Ignoring selling points in an EA/EIS can lead to segmentation and a judicial finding of inadequacy. In other words, addressing the virtues of induced growth while ignoring its disadvantages is certainly not the “environmental full disclosure” required by NEPA and SEPA.

Among the potential externalities of project-induced growth are: increased population, increased traffic, increased pollution, and increased demands for services such as utilities, education, police and fire protection, and recreational facilities. If a project’s justification depends in whole or part on marketing induced growth or other project-generated benefits to the area, e.g., access to a major activity center, then there is no question that such effects are “reasonably foreseeable” and must be included in the NEPA/SEPA document.

4.1.2 Study Area

The study area consists of the broad geographic limits within which the proposed project would likely have an influence. For encroachment-alteration effects, these limits may be defined by the limits of environmental systems, e.g., watershed boundaries or regional landscape units. For induced growth effects, these limits may be defined by the area over which the project could influence travel costs or travel patterns. These limits may be defined by the travel forecasting model, where employed, or an area ranging between 15 and 30 minutes travel time from the proposed project (for induced growth effects, the influence of freeway interchanges generally extends up to a one-mile radius, up to two to five miles along major feeder roadways to the interchange, and up to one-quarter mile around a fixed guideway transit station). Political and U.S. Census geography should also be considered in delimiting the study area for practical purposes.

It should be expected that the study area boundaries will be refined as the project proceeds from planning to project development. Since it is obviously easier to narrow the study area for focus rather than to expand the study area, it is advisable to err on the side of inclusion during the planning phase.

4.1.3 Planning Context

Consistency with local plans is one of the project evaluation criteria for NEPA/SEPA. Potential inconsistency between a project's indirect effects and planned development patterns expressed in adopted plans (as well as zoning adopted to enforce the plans) is a potentially significant issue for the project's NEPA/SEPA evaluation. In addition, the project's cumulative impact assessment needs to account for planned future development as expressed by any relevant adopted plans. In addressing indirect and cumulative impact assessments as part of environmental impact statements, courts have found that current and contemplated plans of private parties and local government outside the direct control of state and Federal government must be reviewed. Based upon that review, reasonable forecasting of the type of development must be conducted.

Land use control in North Carolina, where it is employed, is very similar to comprehensive (synoptic) planning and zoning used widely throughout much of the United States. Zoning regulations are made in accordance with a comprehensive plan and designed to address a public purpose. Zoning regulations are made with consideration as to the character of the district, suitability of particular uses, and a view toward conserving the value of buildings and encouraging the most appropriate use of land as identified by the municipality's planning process.

There are several other formal planning processes in North Carolina, certain of which are geographic specific. Among those covering relatively large areas are the following: multi-objective plans and policies adopted pursuant to the Coastal Area Management Act covering areas within the State's designated coastal zone; long range transportation plans adopted by metropolitan planning organizations covering the State's designated urbanized areas; multi-objective water quality management plans covering the State's river basins; and the State Implementation Plan for air quality standards attainment.

Social, economic, and environmental goals expressed through formal plans reflect a current vision of a desired future. Because of their inherent rippling effect over space and time, one way to measure a transportation system's or project's indirect effects is to envision the future both with and without the system or project improvements. Consideration of various goals early in the planning process can help focus the effort toward balancing transportation and other needs, and also toward understanding potential indirect (and cumulative) effects.

Empirical evidence indicates that transportation investment and changes in land use occur only in the presence of other factors, such as supportive local land use policies and development incentives, availability of developable land, and a good investment climate. Therefore, an understanding of local goals combined with an understanding of the role that a transportation investment could play in achieving these goals, given local circumstances, could lead to the coordinated formulation of a broad range of actions for reaching these goals. Ideally, the desired future or outcome should lead, and the transportation solution combined with other appropriate strategies, e.g., land use, environmental protection, and housing, should follow.

As discussed above, proposed transportation improvements are often planned to support an area's economic development goals. In this case, the anticipated economic growth and land use conversion from that growth are to be treated as indirect effects of the transportation project. Understanding the economic development goals should not only help formulate the scope of the

proposed transportation improvement, but will also help eventually understand the nature of the induced indirect effects.

While it is recommended that available plans be used to help determine the area's various goals, several items should be kept in mind:

- < the age of the plan - In many areas there is no requirement for periodic updating of comprehensive plans even where there is a formal planning process. Political winds tend to change over time and a dated plan may not reflect the area's current needs and goals.
- < the geographic area covered by the plan - Often, an incorporated area may have a comprehensive plan and zoning while an adjoining unincorporated area does not. There is empirical evidence that metropolitan regions where cities have expanded spatially (by annexing adjoining areas) have experienced relatively minimal disinvestment in central business districts, suburban sprawl, and related ills as compared to other regions. The distinction between the incorporated and unincorporated area in terms of current land use may not be clear. However, the absence of land use controls in the unincorporated area and may affect the character of future urbanization in the incorporated area. In addition, one municipality's growth management plan may not conform to the overall plan for a region.
- < who was involved in preparing the plan - It is important to know, for example, whether or not the local citizenry has bought into a resources management plan prepared by a non-local entity.
- < the degree of importance attached to the goals by the public and their decision-making authorities. For example, a history of extensive zoning variances or zoning changes may be indicative of a weak plan. The past three-to-five year history of use and density variance applications versus issuances, as well as outright zoning changes, should be examined in assessing the ability of an area to control growth following a major transportation improvement. The assessment of the resiliency, or lack thereof, of development controls is important as illustrated by two divergent court cases. In one case, the court found that even though zoning changes may be necessary to alter existing uses of land, if a major Federal action makes it likely that such changes will occur, the action will have an indirect effect on the environment. In another case, involving the extension of an interstate highway, the court relied on testimony regarding history of enforcement of the county land use plan as evidence which pointed strongly against induced development because (1) the history of and projected increases in population growth for the study area demonstrated that growth will occur because of market demands even when transportation is lacking; (2) there was already some development in the study area, and development would continue there as planned and allowed under the county's land use plan, whether or not the highway was constructed, because it is the next logical area for development, and (3) all the evidence indicated that the land use plan is, and will continue to be, enforced. It can be concluded that a general rule (or presumption) exists that equates new transportation access with secondary development. However, this presumption can be rebutted through a demonstration of viable and effective regional land use plans which generate confidence in their stringent enforcement.

Adopted comprehensive plans can also provide information on other entities' future actions for consideration in the indirect and cumulative impact assessment. Such information includes that on planned infrastructure (water, sewer, road) construction and expansion; private or public investment in major developments (activity centers) for construction, redevelopment or expansion; and, investments or programs for environmental restoration or preservation. Where applicable, information on the project sponsor (entity responsible), concept and scope, status, and likelihood of occurring should be compiled.

Rural areas in the State generally lack comprehensive land use plans and corresponding zoning. Consequently, it may be prudent to use a public involvement method or methods to gather information on development directions and goals when a major project is planned in a rural area of the State. Even in areas where there is an up-to-date comprehensive plan and an effective land use development review process, it is probably wise to use a public involvement method or methods to at least confirm the directions and goals expressed in the plan, plus to gather information on the area's directions and goals first hand, when appropriate. This greater level of detail may be needed for subsequent indirect effects assessment if issues are anticipated.

A number of public involvement techniques are advocated for obtaining the perceptions or opinions. For example, the U.S. DOT document, *Innovations in Public Involvement for Transportation Planning*, is a notebook which outlines various practical techniques of public involvement that can be used in a variety of situations. The reader should consult these and other pertinent documents for details.

The area's expressed goals give a part of the picture needed to understand potential indirect and cumulative effects in a "big picture" context. It is also important to understand direction, i.e., where an area has been, where it is, and where it is going. Direction can be understood in part by identifying past, present, and anticipated socioeconomic, environmental quality, and land development trends. Equally important is knowing the forces that have shaped landscapes, economic activity, and land use patterns, e.g., transportation system, physical environment, political, and market influences, and how the forces have been influential (the same is true of existing and anticipated forces).

The impacts of past actions (one of the considerations for cumulative impact assessment) can be assessed through a combination of the following techniques (among others):

- < demographic trends (population, employment, educational attainment, household income, etc.) from U.S. Census data.
- < landscape changes from interpretation of a time series of aerial photography and/or local documented historical accounts.
- < concentration of and mix of industries from historic business reports.
- < transportation system development trends and trends in how the transportation system historically influenced land development.

The data collection task for this factor should generally rely on readily attainable sources. The data collection should not be viewed as an end in and of itself, but rather as a foundation for future steps. Data for this purpose can be both quantitative and qualitative. The checklists provided in Tables 1 and 2 are for use in identifying, organizing, and documenting the planning context.

4.1.4 Project Description - Transportation System Context

Changes in accessibility imply changes in travel demand and travel patterns. Modeling of travel demand in transportation systems has been common practice for decades, and is required by federal regulations in urbanized areas. In modeling practice, a project (or change in the system) needs to be of a certain size to produce a measurable change in travel demand or travel patterns. Therefore, it follows that only those projects that could produce a measurable change in travel demand or travel patterns (and, thus, accessibility) need to be examined for indirect and cumulative effects in the transportation system context (regardless of whether the project is in an urbanized area or a rural area). Table 3 provides a checklist for categorizing new highway construction projects on the basis of system characteristics. Table 4 lists transportation project types that potentially change local and regional accessibility.

**TABLE III-1
ORGANIZATION AND TABULATION OF GOALS CHART**

(Check where applicable)

	<u>Notes</u>
<u>Social Health and Well-Being Goals</u>	
___ Achieve adequate, appropriate and accessible open space and recreation	_____
___ Comply with state and federal water and air quality laws	_____
___ Preserve or create multicultural diversity	_____
___ Preserve heritage	_____
___ Provide choice of affordable residential locations	_____
___ Provide urban environment for those with special needs	_____
___ Promote land use patterns with sense of community	_____
___ Provide a range of services accessible to all	_____
___ Promote a healthy and safe environment	_____
___ Provide sound management of solid and hazardous waste	_____
___ Other _____	_____
<u>Economic Opportunity Goals</u>	
___ Support activities to meet changing economic conditions	_____
___ Provide energy-efficient transportation	_____
___ Provide developments with transit-supported capabilities	_____
___ Target economic export activities	_____
___ Attract and maintain workforce	_____
___ Promote infill of smaller, passed-over sites	_____
___ Encourage redevelopment of older areas for new purposes	_____
___ Other _____	_____
<u>Ecosystem Protection Goals</u>	
___ Protect ecosystems	_____
___ Minimize fragmentation	_____
___ Promote native species	_____
___ Protect rare and keystone species	_____
___ Protect sensitive environments	_____
___ Maintain natural processes	_____
___ Maintain natural structural diversity	_____
___ Protect genetic diversity	_____
___ Restore modified ecosystems	_____
___ Other _____	_____

TABLE III-2
STUDY AREA DIRECTIONS AND GOALS CHECKLIST
 (Check where applicable)

1.	Generalized Setting Within Metropolitan Statistical Area (Identify MSA) _____ Outside of MSA _____ Both Inside and Outside MSA _____	Indicate Distance to Nearest Metropolitan Center _____																																
2.	Characteristics of Transportation System (Note: These items are not intended to cover entire transportation need but rather to use information from more detailed assessments to provide a preliminary indication of existing accessibility, service and modal interrelationship characteristics, i.e., factors relevant to subsequent indirect effects analysis). <ul style="list-style-type: none"> • Identify missing links in transportation system _____. • Map and describe existing level of service on minor and principal arterials and their access characteristics. • Indicate distance to nearest interstate highway if not in study area. • Map and describe existing transit routes and demand. • Map and describe major concentrations of existing and planned development. • Describe modal interrelationships including competing and complementary characteristics. 																																	
3.	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Population</th> <th style="text-align: center; border-bottom: 1px solid black;">Trend</th> <th style="text-align: center; border-bottom: 1px solid black;">Projection</th> </tr> </thead> <tbody> <tr> <td>Declining</td> <td style="text-align: center;">_____</td> <td style="text-align: center;">_____</td> </tr> <tr> <td>Static ($\pm 1\%/10$ years)</td> <td style="text-align: center;">_____</td> <td style="text-align: center;">_____</td> </tr> <tr> <td>Slow Growth</td> <td style="text-align: center;">_____</td> <td style="text-align: center;">_____</td> </tr> <tr> <td>Rapid Growth ($>10\%/10$ years)</td> <td style="text-align: center;">_____</td> <td style="text-align: center;">_____</td> </tr> </tbody> </table> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Employment</th> <th style="text-align: center; border-bottom: 1px solid black;">Trend</th> <th style="text-align: center; border-bottom: 1px solid black;">Projection</th> </tr> </thead> <tbody> <tr> <td>Declining</td> <td style="text-align: center;">_____</td> <td style="text-align: center;">_____</td> </tr> <tr> <td>Static ($\pm 1\%/10$ years)</td> <td style="text-align: center;">_____</td> <td style="text-align: center;">_____</td> </tr> <tr> <td>Slow Growth</td> <td style="text-align: center;">_____</td> <td style="text-align: center;">_____</td> </tr> <tr> <td>Rapid Growth ($>10\%/10$ years)</td> <td style="text-align: center;">_____</td> <td style="text-align: center;">_____</td> </tr> </tbody> </table>		Population	Trend	Projection	Declining	_____	_____	Static ($\pm 1\%/10$ years)	_____	_____	Slow Growth	_____	_____	Rapid Growth ($>10\%/10$ years)	_____	_____	Employment	Trend	Projection	Declining	_____	_____	Static ($\pm 1\%/10$ years)	_____	_____	Slow Growth	_____	_____	Rapid Growth ($>10\%/10$ years)	_____	_____		
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4.	Planning Context <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 35%;"></th> <th style="width: 15%; text-align: center;">Yes</th> <th style="width: 15%; text-align: center;">No</th> <th style="width: 35%;"></th> </tr> </thead> <tbody> <tr> <td>Zoning</td> <td style="text-align: center;">_____</td> <td style="text-align: center;">_____</td> <td>_____</td> </tr> <tr> <td>State Master Plan</td> <td style="text-align: center;">_____</td> <td style="text-align: center;">_____</td> <td>_____</td> </tr> <tr> <td>County/Regional Master Plan</td> <td style="text-align: center;">_____</td> <td style="text-align: center;">_____</td> <td>_____</td> </tr> <tr> <td>Municipal Master Plan</td> <td style="text-align: center;">_____</td> <td style="text-align: center;">_____</td> <td>_____</td> </tr> <tr> <td>Growth Management Plan</td> <td style="text-align: center;">_____</td> <td style="text-align: center;">_____</td> <td>_____</td> </tr> <tr> <td>Water Quality Management Plan</td> <td style="text-align: center;">_____</td> <td style="text-align: center;">_____</td> <td>_____</td> </tr> <tr> <td>Other Natural Resources Management Plan</td> <td style="text-align: center;">_____</td> <td style="text-align: center;">_____</td> <td>_____</td> </tr> </tbody> </table>			Yes	No		Zoning	_____	_____	_____	State Master Plan	_____	_____	_____	County/Regional Master Plan	_____	_____	_____	Municipal Master Plan	_____	_____	_____	Growth Management Plan	_____	_____	_____	Water Quality Management Plan	_____	_____	_____	Other Natural Resources Management Plan	_____	_____	_____
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Water Quality Management Plan	_____	_____	_____																															
Other Natural Resources Management Plan	_____	_____	_____																															
5.	For each plan identified in No. 3, summarize key goals, elements and linkages to other plans (specify, in particular, elements related to economic development, land use development, the transportation system, and natural resource protection). _____ _____																																	
6.	Describe any efforts to elicit local needs and goals from residents and/or agencies (source and result). _____ _____																																	
7.	Describe known plans for major new or expanded activity centers including public facilities. _____ _____																																	
	Is the activity center dependent on transportation system improvement? Yes _____ No _____																																	
8.	Is the transportation need linked to economic growth and land development? Yes _____ No _____ If yes, is the nature of the linkage to: Serve the needs of planned growth _____ or Channelize growth _____ or Stimulate growth _____ or																																	
9.	Based on information obtained, are there any apparent conflicts between transportation and other needs that could result in controversy? (Describe). Yes _____ Possible _____ No _____																																	

TABLE III-3
CHARACTERIZATION OF NEW HIGHWAY CONSTRUCTION

1. Type of new construction:

- | | | | |
|----------------------------------|------------------------------|-----------------------------|-----------------|
| a. Bypass: | <input type="checkbox"/> yes | <input type="checkbox"/> no | |
| b. Connector Road: | <input type="checkbox"/> yes | <input type="checkbox"/> no | |
| c. Roadway Relocation: | <input type="checkbox"/> yes | <input type="checkbox"/> no | |
| d. New Highway Construction: | <input type="checkbox"/> yes | <input type="checkbox"/> no | |
| e. New Interchange Construction: | <input type="checkbox"/> yes | <input type="checkbox"/> no | |
| f. Others: | <input type="checkbox"/> yes | <input type="checkbox"/> no | describe: _____ |

Please answer questions 2 and 3 relating to current conditions on the primary existing route. If a model is used, please provide node numbers.

2. Road Section Description

- a. Name (SR Route): _____
- b. From: _____ Node # _____
- c. To: _____ Node # _____
- d. Segment Length: _____
- e. Function Class (Check one):
- | | | |
|---|--|--|
| <input type="checkbox"/> Rural Interstate | <input type="checkbox"/> Other Princ. Art. | <input type="checkbox"/> Minor Art. |
| <input type="checkbox"/> Major Collector | <input type="checkbox"/> Minor Collector | <input type="checkbox"/> Local |
| <input type="checkbox"/> Urban Interstate | <input type="checkbox"/> Other Freeway | <input type="checkbox"/> Other Princ. Art. |
| <input type="checkbox"/> Minor Art. | <input type="checkbox"/> Major Collector | <input type="checkbox"/> Local |
- f. Area Type (check one) ☐ Rural ☐ Small Urban ☐ Urban

3. Traffic Data:

- a. Annual Average Daily Traffic (AADT) Volume: _____ veh/day
The above traffic count is (check one): ☐ One-way ☐ Two-way
- b. Average Weekday Daily Traffic (ADWT) in July: _____ veh/day
- c. The above traffic count is (check one): ☐ One-way ☐ Two-way

Please answer questions 4 and 5 concerning the new alignment. If a model is used, please provide node numbers.

4. New Road Description:

- a. Name (SR Route): _____
- b. From: _____ Node # _____
- c. To: _____ Node # _____
- d. Segment Length: _____

e. Function Class (Check one):

<input type="checkbox"/> Rural Interstate	<input type="checkbox"/> Other Princ. Art.	<input type="checkbox"/> Minor Art.
<input type="checkbox"/> Major Collector	<input type="checkbox"/> Minor Collector	<input type="checkbox"/> Local
<input type="checkbox"/> Urban Interstate	<input type="checkbox"/> Other Freeway	<input type="checkbox"/> Other Princ. Art.
<input type="checkbox"/> Minor Art.	<input type="checkbox"/> Major Collector	<input type="checkbox"/> Local

f. Area Type (check one) ☐ Rural ☐ Small Urban ☐ Urban

5. Traffic Forecast (not needed for model):

a. New alignment volume: Estimated average daily traffic: _____ veh/day
The above traffic estimate is (check one): ☐ One-way ☐ Two-way

b. Estimated Peak Hour Diversion from Parallel Facilities:

i. From Freeways:

From Street: _____ Volume (vph) _____

To Street: _____

From Street: _____ Volume (vph) _____

To Street: _____

From Street: _____ Volume (vph) _____

To Street: _____

ii. From Arterials:

From Street: _____ Volume (vph) _____

To Street: _____

From Street: _____ Volume (vph) _____

To Street: _____

From Street: _____ Volume (vph) _____

To Street: _____

iii. From Locals:

From Street: _____ Volume (vph) _____

To Street: _____

From Street: _____ Volume (vph) _____

To Street: _____

From Street: _____ Volume (vph) _____

To Street: _____

TABLE III-4
EXAMPLES OF MINIMUM PROJECTS WHICH POTENTIALLY CHANGE
LOCAL OR REGIONAL ACCESSIBILITY

- 1) Highway/Roadway
 - a) New construction or new alignment. Principal Arterial or above, 1 mile or longer;
 - b) Widening of Principal Arterial or above to provide additional through-traffic lanes, 1 mile or longer (urban) or 2.5 miles or longer (rural);
 - c) Additional grade-separated ramps or new interchanges on Principal Arterials or above.
- 2) Transit/Rail
 - a) New passenger rail service and extensions of existing service, 5 miles or longer;
 - b) Purchase of additional (not replacement) rolling stock to support increased frequency and higher ridership;
 - c) Rail connections to provide new regional service;
 - d) New rail stations and new or expanded rail park-and-ride facilities resulting in 100 new parking spaces.

4.1.5 Environmental Context

An inventory of baseline environmental conditions is typically done as a project proposal is being developed, usually prior to the NEPA class of action determination. The typical inventory has become fairly routine, and the sources of data to undertake the typical inventory are relatively well established. The baseline environmental screening can be used as a tool to identify notable features, or specific valued, vulnerable or unique elements of the environment. The objective of this step is to identify specific environmental issues within the study area against which the project may be assessed.

Whether from encroachment-alteration or project-induced growth, indirect effects from transportation projects change the environment. Society has preferences for how much change is acceptable. The acceptability of the degree of change varies depending on the affected setting or population. A number of terms are found in the literature that describe settings or populations commonly afforded special attention with respect to change. The term *notable features* is used in this study as an overarching term that encompasses the various terms found in the literature, e.g., *sensitive species and habitats*, *valued environmental component*, *unusual landscape features*, *vulnerable elements of the population*.

What constitutes a notable feature depends on perspective (there are likely many other perspectives or disciplines of study not discussed here that are captured by the term *notable features*). Therefore, the inventory should cast as wide a net as possible on perspectives. Similarly, the definition of notable features in an area depends on scale. What is notable to a region will often differ from what is notable to a community or city. The various geographic scales should be examined in keeping with the CEQ regulations which state that significance varies with context.

The objective of the environmental inventory step of the typical transportation project development process is to gather information about baseline environmental conditions. Indirect and cumulative effects assessment requires a “big picture” approach. Tables 5 and 6 are to be used by the analyst to perform the requisite “big picture” inventory. Notable features can then be gleaned from the inventory lists using the checklists presented at Tables 7 and 8. Table 8 was prepared to note that through enactment of laws, society as a whole has in effect placed a value on certain resources or determined that certain resources require special consideration before actions like transportation projects are undertaken. Table 8 lists pertinent federal laws; state and local transportation agencies should expand the list to include pertinent state and local laws.

The following are potentially useful sources of ecological information:

- < National Biological Service.
- < National Heritage Program Network.
- < Fish and Wildlife Information Exchange.
- < Regional Natural Resource Plans.
- < Resource Agency Management Plans.

TABLE III-5
ECOSYSTEM CONDITIONS INVENTORY

Setting	Describe/Characterize (Map Locations)
— Suburban Landscapes Remnant Communities Greenways Remnant Populations Wetlands and Riparian Zones Drainage Patterns Natural Vegetation Diversity	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
— Rural Watersheds Local Ecosystem Integrity Riparian Corridors Endemics and Migratory Species Riparian and Forest Corridors Hydrology Landscape Pattern Diversity Dispersal Routes	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
— Wildland Regional Ecosystems Remote Habitat Contiguous Habitat Habitat Interior Species Unique Environments Structural Components of Interior Habitat Subpopulation Movements	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>

TABLE III-6
SOCIOECONOMIC CONDITIONS INVENTORY

	<u>Describe/Characterize</u>
Economic	
Residents' occupational mix	_____
Jobs in community (mix)	_____
Jobs/housing balance (self-containment)	_____
Income distribution mix	_____
Journey to work (length and mode)	_____
Job growth rate	_____
Business ownership and services characteristics	_____
Demographic	
Population growth rate	_____
Population age mix	_____
Household types	_____
Retired population percent	_____
Social	
Community cohesion	_____
Crime rates	_____
Clubs, sports and organizations participation	_____
Education levels mix	_____
Sense of control over change	_____
Balance of old timers and newcomers	_____
Physical	
Housing stock mix and values	_____
Open space percent	_____
Town area and form	_____
Separation from other activity centers	_____
Residential density	_____
Mix of land uses	_____
Town edge activity	_____
Historic structures and places	_____
Circulation and traffic characteristics	_____
Neighborhood design characteristics	_____
Infrastructure character	_____
Commercial building scale	_____
Town entrance setting	_____
Scenic character	_____
Trees and vegetation presence	_____
Noise levels and timing	_____
Lighting influence	_____

TABLE III-7
NOTABLE FEATURES CHECKLIST
 (Check where applicable)

	<u>Specify</u>
<u>Ecosystem Features</u>	
<input type="checkbox"/> Regional habitats of concern/critical areas	<hr/>
<input type="checkbox"/> Rare, threatened or endangered species and associated habitat	<hr/>
<input type="checkbox"/> Species requiring high survival rates	<hr/>
<input type="checkbox"/> Species whose intrinsic rates of increase fluctuate greatly	<hr/>
<input type="checkbox"/> Communities with vulnerable keystone predators or materialists	<hr/>
<input type="checkbox"/> Other _____	<hr/>
<u>Socioeconomic Features</u>	
<input type="checkbox"/> Substandard amounts of open space and recreation	<hr/>
<input type="checkbox"/> Non-compliance with state and federal environmental laws	<hr/>
<input type="checkbox"/> High concentration of uncontrolled solid and hazardous waste sites	<hr/>
<input type="checkbox"/> Inadequate affordable housing	<hr/>
<input type="checkbox"/> Inadequate access to amenities	<hr/>
<input type="checkbox"/> Economically distressed areas	<hr/>
<input type="checkbox"/> Lack of institutional land use controls	<hr/>
<input type="checkbox"/> High proportion of population consisting of:	<hr/>
<input type="checkbox"/> Minorities	<hr/>
<input type="checkbox"/> Low-income residents	<hr/>
<input type="checkbox"/> Elderly	<hr/>
<input type="checkbox"/> Young	<hr/>
<input type="checkbox"/> Disabled	<hr/>
<input type="checkbox"/> Low proportion of long-term residents	<hr/>
<input type="checkbox"/> Locations of poor traffic flow	<hr/>
<input type="checkbox"/> Other _____	<hr/>

TABLE 8
NOTABLE FEATURES ADDRESSED BY FEDERAL AND NORTH CAROLINA STATUTES
 (Check where applicable)

Resource Type or Area or Issue	Statute/Order	Sources of Information, Data, Map Locations, etc.
<input type="checkbox"/> Section 4(f) Resources <input type="checkbox"/> Public Parks and Recreational Lands <input type="checkbox"/> Wildlife and Waterfowl Refuges <input type="checkbox"/> Historic Sites <input type="checkbox"/> Historic or Archaeological Districts <input type="checkbox"/> Archaeological Sites <input type="checkbox"/> Historic Structures	National Historic Preservation Act of 1966 [16 USC §461-470; 36 CFR Part 800]; Transportation Equity Act for the 21 st Century (TEA-21, 1998) [23 USC; PL 105-178 and as amended 105-206]; DOT Act [23 USC §138, 49 USC §303(c), 23 CFR 771.135]; Act for the Preservation of American Antiquities [16 USC §431-433]; American Indian Religious Freedom Act [42 USC §1996]; Native American Grave Protection and Repatriation Act [25 USC §3001-3013]; Historic Bridges [23 USC §144(0)]; Wilderness Act [16 USC §1131-1136]; Land and Water Conservation Fund Act [16 USC §460-4 to 460-11]; National Trails Systems Act (16 USC §1241-1249)	<ul style="list-style-type: none"> • U.S. Department of the Interior, Fish & Wildlife Service (USFWS); U.S. Department of the Interior, Bureau of Indian Affairs; U.S. Department of the Interior, National Parks Service (NPS); National Archives and Records Administration (NARA); U.S. Department of Agriculture, Forest Service (USFS); Bureau of Land Management (BLM); • North Carolina Department of Cultural Resources, Division of Archives and History; North Carolina Department of Environment and Natural Resources (NCDENR), Division of Parks and Recreation; • Local Parks and Recreation Officials; • Local historic preservation and genealogical organizations
<input type="checkbox"/> Coastal Zone <input type="checkbox"/> Coastal Wetlands <input type="checkbox"/> Navigable Waters	Coastal Zone Management Act of 1972 [16 USC 33 §1451-1465; Clean Water Act [33 USC 1344]; E.O. 11990-Protection of Wetlands; Rivers and Harbor Act of 1899 [33 USC 1344]; North Carolina Coastal Area Management Act 1974 (CAMA) [7 NCGS 113A-100-134.3]; North Carolina Water Quality Certification Rules [15A NCAC 2H .0500]; Coastal Barriers Resources Act [16 USC §3501-3510]; CAMA Rules EIS NCAC 7H.0208]	<ul style="list-style-type: none"> • NCDENR, Division of Coastal Management; NCDENR, Division of Water Quality; • U.S. Army Corps of Engineers (USACE)
<input type="checkbox"/> Waters of the United States <input type="checkbox"/> Jurisdictional Wetlands <input type="checkbox"/> Coastal Wetlands (see Coastal Zone) <input type="checkbox"/> Navigable Waters <input type="checkbox"/> Wetland Mitigation	Clean Water Act [33 USC 1251-1376]; E.O. 11990-Protection of Wetlands; Rivers and Harbor Act of 1899 [33 USC 401 <i>et seq.</i>]; State Watershed Buffer Rules, [15A NCAC 2B .0233, .0242, .0259. And .0260]; North Carolina Water Quality Certification Rules [15A NCAC 2H .0500]; Wetland Restoration Program rules [15A NCAC 2R.100]	<ul style="list-style-type: none"> • U.S. Army Corps of Engineers (USACE); U.S. Coast Guard; • NCDENR, Division of Water Quality
<input type="checkbox"/> Stream Buffers	State Watershed Buffer Rules, [15A NCAC 2B .0233, .0242, .0259, and .0260]	<ul style="list-style-type: none"> • NCDENR, Division of Water Quality

TABLE 8 (CONTINUED)
NOTABLE FEATURES ADDRESSED BY FEDERAL AND NORTH CAROLINA STATUTES
 (Check where applicable)

__ Sedimentation	Sedimentation Pollution Control Act [NCGS 113 A-50-66]	<ul style="list-style-type: none"> • NCDENR, Division of Water Quality
__ Stormwater	NC Regulations 15A NCAC 2H.1000	<ul style="list-style-type: none"> • NCDENR, Division of Water Quality
__ Sole Source Aquifer	Safe Drinking Water Act [42 USC §300F-300J-6]	<ul style="list-style-type: none"> • NCDENR, Division of Water Quality; NCDENR, Division of Environmental Health
__ Floodplains	E.O. 11988, Floodplain Management (as amended by E.O. 12148); Flood Disaster Protection Act [42 USC §4001-4128]; NC Floodplain [NCGS §143-215.51 - 215.61]	<ul style="list-style-type: none"> • Federal Emergency Management Agency (FEMA); • North Carolina Department of Transportation (NCDOT)
__ Threatened and Endangered Species __ Rare/Unique Habitat	Endangered Species Act of 1973 [16 USC §1531 <i>et seq</i>]; Fish and Wildlife Coordination Act [16 USC 661 <i>et seq</i>]; Marine Mammal Protection Act of 1972 [16 USC §1361 <i>et seq</i>]; North Carolina Endangered Species Act [NCGS 113-331 to 113-337]; North Carolina Plant Protection and Conservation Act of 1979 [NCGS 106-202.12 to 106-202.22]	<ul style="list-style-type: none"> • U.S. Fish & Wildlife Service (USFWS); U.S. Department of Commerce, Marine Fisheries Service; • NCDENR, Division of Parks and Recreation, Natural Heritage Program; NCDENR, Wildlife Resources Commission (WRC); North Carolina Department of Agriculture
__ Areas of known contamination __ Solid Waste	Comprehensive Environmental Response Compensation Liability Act (CERCLA) [42 USC §9601-9675]; Resource Conservation and Recovery Act (RCRA) [42 USC 6901 <i>et seq</i> (40 CFR Parts 240-271)]	<ul style="list-style-type: none"> • U.S. Environmental Protection Agency (USEPA); • NCDENR, Division of Waste Management
__ Wild, Scenic or Recreational Waters	Wild and Scenic Rivers Act [16 USC §1271-1287; Public Law 90-542]; Rivers and Harbor Act of 1899 [33 USC 403]	<ul style="list-style-type: none"> • U.S. Department of the Interior, National Parks Service (NPS); U.S. Army Corps of Engineers (USACE); • NCDENR, Division of Coastal Management
__ Surface Water	Classifications and Water Quality Standards Applicable to Surface Waters and Wetlands of North Carolina [15A NCAC 2B .0200]	<ul style="list-style-type: none"> • NCDENR, Division of Water Quality

TABLE 8 (CONTINUED)
NOTABLE FEATURES ADDRESSED BY FEDERAL AND NORTH CAROLINA STATUTES
 (Check where applicable)

___ Ground Water	NC Groundwater Classification and Standards [15A NCAC 2L.0100]	<ul style="list-style-type: none"> • NCDENR, Division of Water Quality
___ Prime or Unique Farmland	Farmland Protection Act [7 USC §4201-4209]	<ul style="list-style-type: none"> • U.S. Department of Agriculture (USDA), Natural Resource Conservation Service (NRCS)
___ Sensitive Receptors	Noise Control Act [23 USC §109(i)]	<ul style="list-style-type: none"> • U.S. Environmental Protection Agency (USEPA); • North Carolina Department of Transportation (NCDOT)
___ Nonattainment or Maintenance Areas ___ Sensitive Receptors	Clean Air Act [42 U.S.C. §7609 {CAA §309} 40 CFR Part 93]; NC Clean Air Rules [15A NCAC 2D .0100-.2000]	<ul style="list-style-type: none"> • U.S. Environmental Protection Agency (USEPA); • North Carolina Department of Transportation (NCDOT); NCDENR, Division of Air Quality
___ Communities and Residential or Commercial Property	Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 [42 USC §4602 <i>et seq</i>]; North Carolina Relocation Assistance Act [NCGS 133-5-18]; E.O. 12898-Environmental Justice	<ul style="list-style-type: none"> • U.S. Department of Commerce, Census Bureau; • Local governments; • Local citizens groups (Church, School, Social, Unions, Chamber of Commerce, Realtors), Individual citizens
___ Environmental Justice	Civil Rights Act [Title VI:42 USC §2000D (60 FR 33896) <i>et seq.</i>]; E.O. 12898-Environmental Justice	<ul style="list-style-type: none"> • U.S. Department of Commerce, Census Bureau; • Local governments; • Local citizens groups (Church, School, Social, Unions, Chamber of Commerce, Realtors), Individual citizens

The following are potentially useful sources of socioeconomic information:

- < comprehensive plan, historical studies of the community, newspaper accounts of public opinion.
- < published statistics - existing measures and future projections of demographic factors in area, region, and nearby areas from U.S. Census, comprehensive plans, and utility companies; journey-to-work statistics from the U.S. Census. Within an urbanized area, the metropolitan planning organization should be consulted for population and employment statistics since it would have these and the future, locally approved projects for use in transportation planning.
- < citizen survey or focus groups to ascertain what people like most about the area, where they would take visitors to give them a feel for the area (uniqueness).
- < field studies to analyze physical elements of neighborhood or community form.

Field investigations should be performed, particularly during project development, to confirm secondary source information or to investigate items not identified through readily available information. Following confirmation, the location and extent of inventoried items should be mapped and/or tabulated.

It is possible that a project study area could contain a number of possible notable features, and differing views of what is notable or why it is notable. For these reasons, it is in a transportation agency's interest to have as many interested parties, e.g., resource agencies, as necessary involved in determining what are notable features for a particular study area.

4.1.6 Project Description - Design Context

At the stage where alignment and design alternatives are under consideration, more precise knowledge of project details allows for closer attention to encroachment-alteration effects and impacts to notable features in the environment. Particular attention should be paid to the effects of linear crossings on non-linear community and ecological features. The limits of disturbances to the environment can also be more precisely determined. Table 9 provides a checklist of project impact causing activities that can be used to identify these types of effects. Knowledge of project design also allows for identification of the full range of induced growth effects including more localized highway-oriented commercial development centered around access points.

TABLE III-9
PROJECT IMPACT-CAUSING ACTIVITIES CHECKLIST

	If Yes,		
	Yes	No	Describe Generally (Breadth, Duration, Location and Type)
<u>Modification of Regime</u>			
Exotic Flora Introduction	___	___	_____
Modification of Habitat	___	___	_____
Alteration of Ground Cover	___	___	_____
Alteration of Groundwater Hydrology	___	___	_____
Alteration of Drainage	___	___	_____
River Control and Flow Modification	___	___	_____
Channelization	___	___	_____
Noise and Vibration	___	___	_____
<u>Land Transformation and Construction</u>			
New or Expanded Transportation Facility	___	___	_____
Service or Support Sites and Buildings	___	___	_____
New or Expanded Service or Frontage Roads	___	___	_____
Ancillary Transmission Lines, Pipelines and Corridors	___	___	_____
Barriers, Including Fencing	___	___	_____
Channel Dredging and Straightening	___	___	_____
Channel Revetments	___	___	_____
Canals	___	___	_____
Bulkheads or Seawalls	___	___	_____
Cut and Fill	___	___	_____
<u>Resource Extraction</u>			
Surface Excavation	___	___	_____
Subsurface Excavation	___	___	_____
Dredging	___	___	_____
<u>Processing</u>			
Product Storage	___	___	_____
<u>Land Alteration</u>			
Erosion Control and Terracing	___	___	_____
Mine Sealing and Waste Control	___	___	_____
Landscaping	___	___	_____
Wetland or Open Water Fill and Drainage	___	___	_____
Harbor Dredging	___	___	_____
<u>Resource Renewal</u>			
Reforestation	___	___	_____
Groundwater Recharge	___	___	_____
Waste Recycling	___	___	_____
Site Remediation	___	___	_____
<u>Changes in Traffic (including adjoining facilities)</u>			
Railroad	___	___	_____
Transit (Bus)	___	___	_____
Transit (Fixed Guideway)	___	___	_____
Automobile	___	___	_____
Trucking	___	___	_____
Aircraft	___	___	_____
River and Canal Traffic	___	___	_____
Pleasure Boating	___	___	_____
Communication	___	___	_____
Operational or Service Charge	___	___	_____
<u>Waste Emplacement and Treatment</u>			
Landfill	___	___	_____
Emplacement of Spoil and Overburden	___	___	_____
Underground Storage	___	___	_____
Sanitary Waste Discharge	___	___	_____
Septic Tanks	___	___	_____
Stack and Exhaust Emission	___	___	_____
<u>Chemical Treatment</u>			
Fertilization	___	___	_____
Chemical Deicing	___	___	_____
Chemical Soil Stabilization	___	___	_____
Weed Control	___	___	_____
Pest Control	___	___	_____
<u>Access Alteration</u>			
New or Expanded Access to Activity Center	___	___	_____
New or Expanded Access to Undeveloped Land	___	___	_____
Alter Travel Circulation Patterns	___	___	_____
Alter Travel Times between Major Trip Productions and Attractions	___	___	_____
Alter Travel Costs between Major Trip Productions and Attractions	___	___	_____
<u>Others</u>			
_____	___	___	_____
_____	___	___	_____
_____	___	___	_____

4.2 Identification of Potentially Significant Issues and Effects

Indirect and cumulative effects fall into three broad categories discussed in detail below. Potential effects in each of these categories should be considered for their relevance to the project and significance in the study area.

4.2.1 Induced Growth Effects

Transportation improvements often reduce the time-cost of travel enhancing the attractiveness of surrounding land to developers and consumers. Development on vacant land or conversion of the built environment to more intensive uses is often a consequence of highway and transit projects. Growth in population and employment attributable to a direct project effect (change in accessibility) is an indirect effect that produces its own effects on the environment.

Important characteristics of induced growth are illustrated in the attached figures:

- < The land-use impacts of highway investment vary depending on existing land-use conditions in the project area (see Figure 2).
- < Transportation investments can prompt changes in economic, social, and demographic conditions which can alter location decisions and land use (see Figure 3)
- < A transportation investment and the increased accessibility that it brings is just one factor in the development decision-making process. Other factors include: location attractiveness, consumer preferences, the existence of other infrastructure, local political and economic conditions, and the rate and path of urbanization in the region (see Figure 4).

Induced growth effects fall into three general categories:

4.2.1.1 Projects Planned to Serve Specific Land Development

Transportation projects designed specifically to serve existing or planned large land development projects or groups of projects require a thorough analysis of induced growth and related effects. This is because:

- < land development is highly likely
- < the magnitude and timing of the development are known or generally predictable
- < details of development projects are known and can be analyzed for environmental effects

Since the land development projects are known, analysis of this type of growth is related more to the evaluation of cumulative effects than indirect effects. The analysis will also require a greater focus on impacts related to the timing of development than its probability.

Figure 1 **HIGHWAY INVESTMENT IMPACT ON TYPICAL PROGRESS OF URBANIZATION**

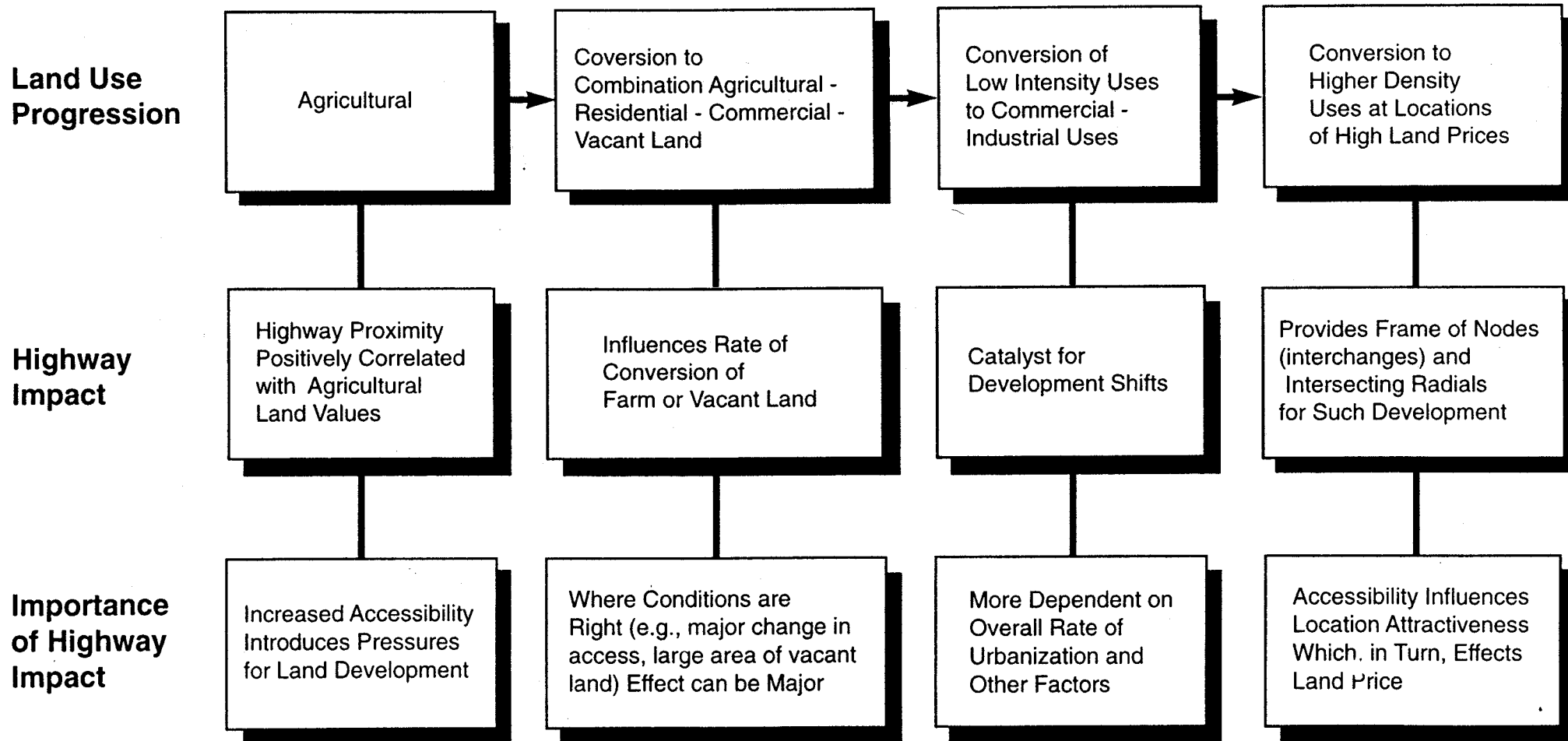


Figure 2

TRANSPORTATION ACCESS-LAND USE CHANGE LINKAGE

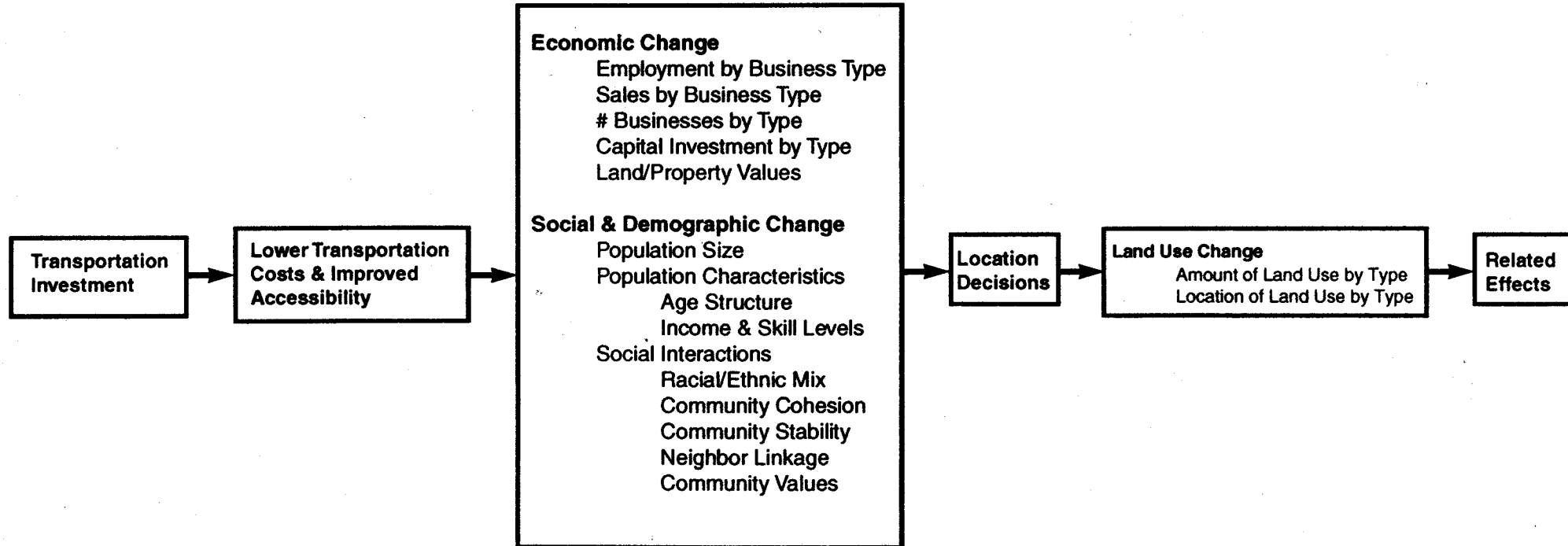
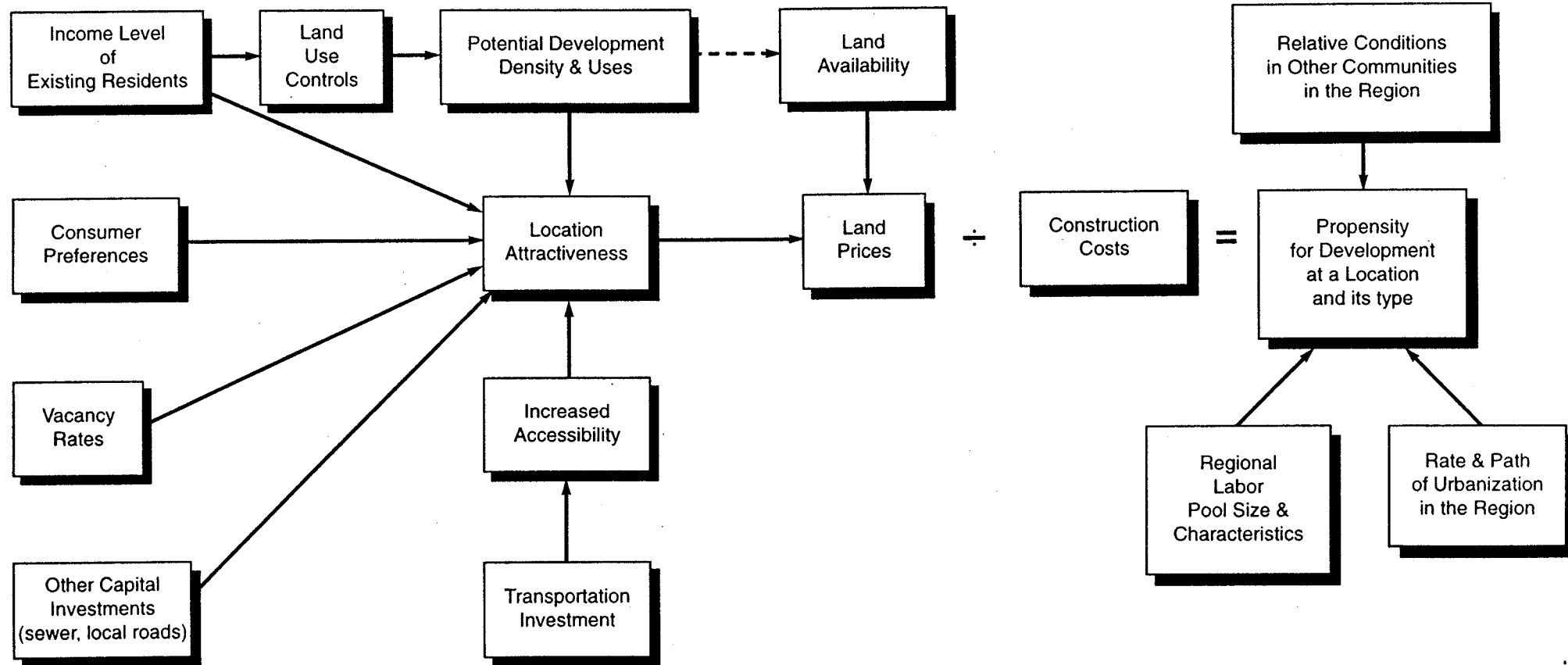


Figure 3

SIMPLIFIED MODEL OF VARIOUS FACTORS INFLUENCING DEVELOPMENT LOCATION DECISIONS



4.2.1.2 Projects Likely to Stimulate Complementary Land Development

Complementary land development, such as highway-oriented businesses (gas stations, rest stops, motels), is more likely near interchanges in rural areas where property values were originally low. Interchanges in suburban or urban areas where property values were higher before the project are more likely to support a greater proportion of higher density uses, as well as a greater mix of uses. Factors influencing the likelihood and rate of development near rural interchanges include:

- < distance to major urban area or regional center (proximity corresponds to higher probability of development)
- < traffic volume on the intersecting road (higher volumes correspond to higher probability of development)
- < presence of frontage road (greater potential for intensive development)
- < availability of water and sewer (greater potential for development)

If these factors are present, induced growth effects of this type warrant analysis.

Common patterns of development:

- < Interchange quadrants on the right-hand side of motorists approaching the interchange from the main road have higher visibility and are often developed first.
- < Transit projects with stops in suburban or urban areas may produce higher density commercial and residential uses and complementary retail and service development such as coffee shops, dry cleaners, and newsstands.

4.2.1.3 Projects Likely to Influence Intraregional Location Decisions (Development Shifts)

Apart from the complementary development described above, on a regional basis, the impact of highway and transit projects is generally minimal. The localized effect of such projects on land use can be substantial, however. If the conditions for development are generally favorable in a region, i.e., the region is undergoing urbanization, then highway and transit projects can become one of the major factors that influence where development will occur, and project-induced growth warrants evaluation.

Where transportation projects do influence land development, the general tendency is toward relatively high density commercial or multi-family residential development near facility nodes in urban and suburban areas and single-family residential development in the urban fringe.

Development effects are most often found:

- < up to one mile around a freeway interchange
- < up to two to five miles along major feeder roadways to the interchange
- < up to one-half mile around a transit station

General circumstances influencing the likelihood of induced development shifts include:

- < Extent and maturity of existing transportation infrastructure - influence of highway projects diminishes with successive improvements because each new improvement brings a successively smaller increase in accessibility
- < Land availability and price are key determinants of development; property values are de-facto indicators of the potential for land use change because investment decisions revolve around market prices.
- < State of the regional economy - even if changes in accessibility are great, development is not likely to occur if the regional economy will not support new jobs and households
- < Area vacancy rates - high local vacancy rates in housing or commercial space of good quality may be absorbed before any shift in development to the project area is seen.
- < Location attractiveness - quality of existing development, local politics, growth history, are all factors considered in addition to transportation availability and cost.
- < Land use controls - development is shaped by zoning ordinances and other land use controls that influence the amount of land available for various uses, the densities permitted, and the costs of development. Pressures for development can prompt communities to alter land use controls, however, and an evaluation should be made which considers the likelihood that changes in land use controls will occur. Such an evaluation can consider the historical record of zoning enforcement and granting of variances, whether the controls are rooted in long range comprehensive plans, and the existing amount of undeveloped land for each use.

If these conditions are favorable for development, a detailed analysis of induced growth and its potential for impact on important area goals or notable features is warranted.

Review of recent indirect effects case law suggests that analysis of induced growth effects is required whenever economic development is cited in the statement of purpose and need for the project.

4.2.2 Effects Related to Induced Growth

Induced growth and land development themselves can affect the environment in many possible ways. A general tabulation of possible land development effects is presented in Table 10. A tabulation of possible socioeconomic effects of land development from is presented in Table 11. Obviously, the degree of certainty, specificity, and need to know about the induced effects will determine the extent that the corresponding related effects should be examined.

One particular effect related to induced growth, the effect of transportation investments on air quality vis-a-vis land use change, has come to the forefront in recent years. From the above discussion, it is clear that transportation investments influence land use under certain circumstances. Empirical data suggests that transportation investments worsen per capita emissions when they support development at the urban fringe, i.e., the location where the lowest density and highest travel consumption are found. From this it is inferred that transportation investments will improve per capita emissions when they create arrangements of land uses that require less vehicular travel.

However, the relationship between travel and land use is complex. For example, income accounts for a portion of travel variability with land use. In addition, insufficient data is available to determine causality, e.g., whether low density residential development "causes" people to have more vehicle travel or whether people with a proclivity toward extensive auto mobility select low density areas for living. Regardless, the general interrelationships among transportation investment, land use, and air quality merit exploration particularly for those plans or projects that involve the urban fringe (generally high land availability/low land prices in an urbanizing area).

TABLE III-10
INDICATORS USED TO MEASURE EFFECTS OF LAND DEVELOPMENT

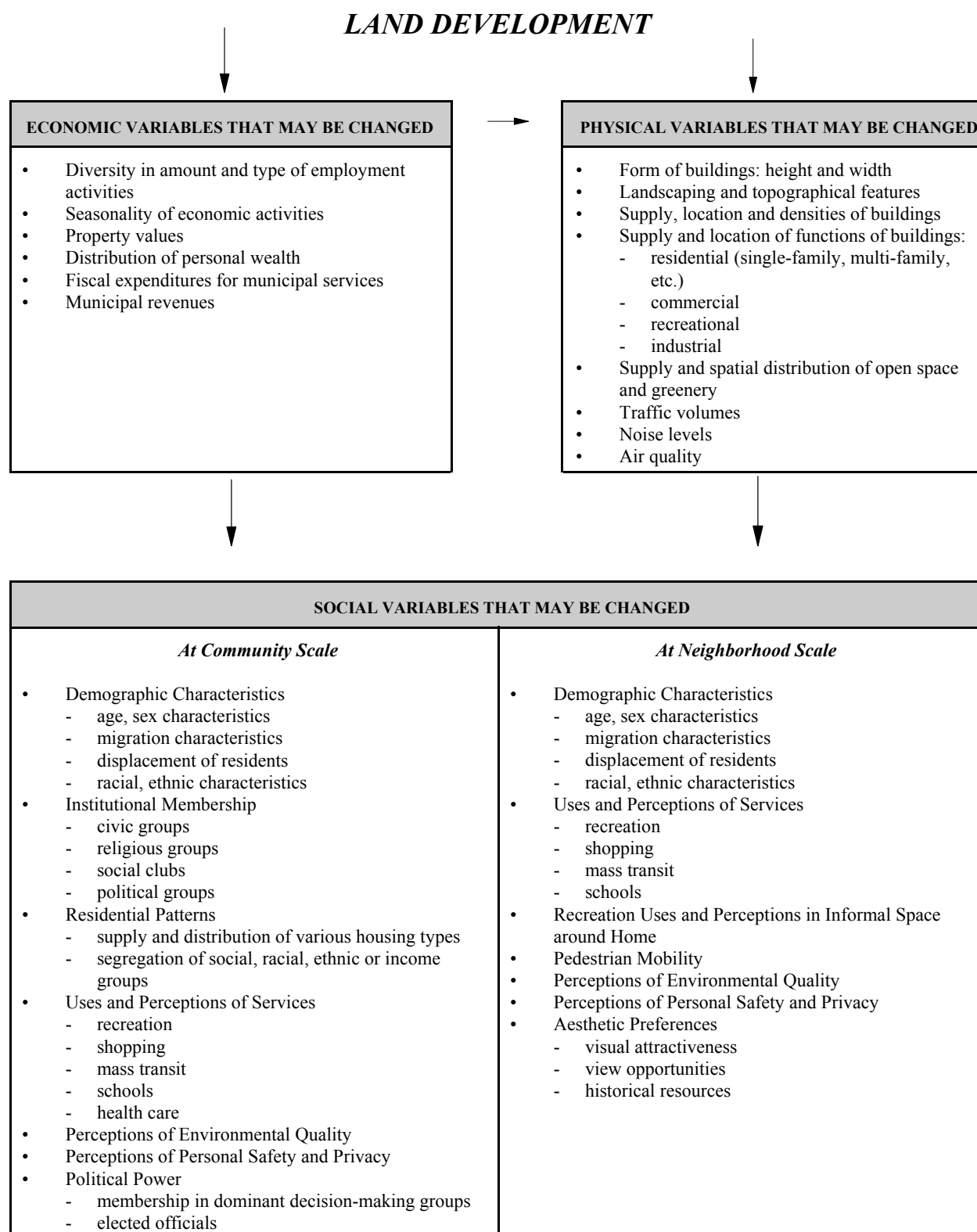
Impacted Sector	Variable	Indicator
Economic	Public Fiscal Balance	1) Net change in government fiscal flow.
	Employment	2) Number of new long-term and short-term jobs provided. 3) Change in numbers and percent employed, unemployed, and underemployed.
	Wealth	4) Change in land values.
Natural Environment	Air Pollution	5) Change in level of air pollutants and change in number of people at risk or bothered by pollution.
	Water Pollution	6) Change in the level of water pollutants, change in tolerably types of use, and number of persons affected, for each body of water.
	Noise Pollution	7) Change in noise and vibration levels, and the number of people bothered by excessive noise and vibration.
	Greenery and Open Space	8) Amount and percent change in greenery and open space.
	Wildlife and Vegetation	9) Number and types of rare or endangered species that will be threatened. 10) Change in the abundance and diversity of wildlife and vegetation in the development and community.
	Scarce Resource Consumption	11) Change in the frequency, duration and magnitude of shortages of critically scarce resources, and the number of persons affected.
	Natural Disasters	12) Change in number of people and value of property endangered by flooding, earthquakes, landslides, mudslides, and other natural disasters.
Aesthetic and Cultural Values	Views	13) Number of people whose views or sightlines are blocked, degraded, or improved.
	Attractiveness	14) Visual attractiveness of the development as rated by citizens and “experts.” 15) Percent of citizens who think the development improves or lessens overall neighborhood attractiveness, pleasantness, and uniqueness.
	Landmarks	16) Rarity and perceived importance of cultural, historic, or scientific landmarks to be lost or made inaccessible.

Impacted Sector	Variable	Indicator
Public and Private Services	Drinking Water	17) Change in the rate of water shortage incidents. 18) Change in indexes of drinking water quality and safety.
	Hospitable Care	19) Change in number of citizens who are beyond x minutes travel time from a hospital emergency room (using such time as the community considers reasonable). 20) Change in average number of days of waiting time for hospital admittance for elective surgery.
	Crime Control	21) Change in rate of crimes in existing community of new development (or expert rating of change in hazard presented). 22) Change in percent of people feeling a lack of security from crime.
	Fire Protection	23) Change in incidence rates. 24) Change in rating of fire spread and rescue hazards.
	Recreation	25) Change in the number of people within or beyond a reasonable distance (x miles or y minutes) from recreational facilities, by type of facility. 26) Change in usage as a percent of capacity; waiting times; number of people turned away; facility space per resident; and citizen perceptions of crowdedness at recreational facilities. 27) Change in perceived pleasantness of recreational experience.
	Education	28) Change in number of students within x minutes walk or y minutes ride from school, by type of school. 29) Number and percent of students having to switch schools or busing status (from walking to busing or vice versa). 30) Change in crowdedness “breakpoints” (such as needed for added shifts) or indicators (such as student-teacher ratio); and student, teacher, and parent perceptions of crowdedness and pleasantness of schooling.
	Local Transportation	31) Change in vehicular travel times between selected origins and destinations. 32) Change in duration and severity of congestion. 33) Change in likelihood of finding a satisfactory parking space within x distance from destination or residence. 34) Change in numbers and percent of residents with access to public transit within x feet of their residences; and numbers and percent of employees who can get within x distance of work location by public transit. 35) Change in the rate of traffic accidents (or expert rating of change in hazard presented). 36) Number and percent of citizens perceiving a change in neighborhood traffic hazard; and change in pedestrian usage of streets, sidewalks, and other outdoor space.

Impacted Sector	Variable	Indicator
Public and Private Services (Continued)	Shopping	37) Change in the number of stores and services, by type, available within x distance of people. 38) Change in the percent of people generally satisfied with local shopping conditions (access, variety, crowdedness).
	Housing Adequacy	39) Change in number and percent of housing units that are substandard, and change in number and percent of people living in such units. 40) Change in number and percent of housing units by type (price or rent range, zoning category, owner-occupied and rental, etc.) relative to demand or to number of families in various income classes in the community.
	People Displaced	41) Number of residents or workers displaced by development — and whether they are satisfied with having to move.
	Population Mix	42) Change in the population distribution by age, income, religion, racial or ethnic group, occupational class, and household type.
	Crowdedness	43) Change in the percent of people who perceive their neighborhood as too crowded.
	Sociability/ Friendliness	44) Change in frequency of visits to friends among people in the existing neighborhood, and frequency of visits between people in the existing neighborhood and the new development. 45) Change in the percent of people perceiving their neighborhood as friendly. 46) Number and percent of people with change in “visual” or “auditory” privacy. 47) Number and percent of people perceiving a loss in privacy.
	Overall Contentment with Neighborhood	48) Change in percent of people who perceive their community as a good place to live.

Source: Schaenman and Miller, November 1974.

TABLE III-11
POSSIBLE EFFECTS OF LAND DEVELOPMENT
ON SOCIOECONOMIC VARIABLES



4.2.3 Encroachment-Alteration Effects

Alteration of the behavior and functioning of the affected environment caused by project encroachment can be characterized into two broad categories:

4.2.3.1 Ecological Effects

Transportation corridors have unique impact on ecosystems associated with their linear form. These corridors may function as specialized habitats, conduits of movement, barriers or filters to movement, or sources of effects on surrounding habitats. Improvements within corridors can have consequences to habitats removed in time and distance from the project. Together with other human actions the cumulative effects can be significant.

The following indirect and cumulative effects of transportation project actions can have important consequences for ecosystems (see Table 12):

- < Habitat fragmentation from physical alteration of the environment
- < Lethal, sublethal and reproduction effects from pollution,
- < Degradation of habitat from pollution,
- < Disruption of ecosystem functioning from direct mortality impacts,
- < Disruption of natural processes (*i.e.*, hydrology, species competition, predator-prey relations, etc.) from altered energy flows.

The ability of an ecosystem to respond to a disturbance or perturbation from a transportation project is a function of its *resistance* (the ability of the ecosystem to withstand or resist variation imposed by disturbance or perturbation) and *recovery* (the ability of an ecosystem to respond after being changed). Note that different elements of an ecosystem will have different rates of resistance and recovery which also interact with each other.

TABLE III-12
SOME POSSIBLE EFFECTS ON ECOSYSTEMS FROM TRANSPORTATION PROJECTS

Direct Effect	Indirect Effect	Some Manifestations	Possible Consequences (from individual effects or combination of effects)
<ul style="list-style-type: none"> Physical Alteration—Habitat Destruction 	<ul style="list-style-type: none"> Habitat Fragmentation 	<ul style="list-style-type: none"> Creation of Smaller Patches Creation of Barriers Creation of More Edges Draining or Ponding 	<ul style="list-style-type: none"> Local extinction of wide-ranging species Loss of interior or area-sensitive species Direct mortality impacts Erosion of genetic diversity and amplification of inbreeding (particularly for isolated sedentary species) Increased probability of local extinction from small population sizes and reduced likelihood of re-establishment (because immigration is inhibited by barriers) Increased abundance of weedy species Generally, reduced biological diversity
<ul style="list-style-type: none"> Introduction of Pollutants—Toxicity and Behavioral Effects 	<ul style="list-style-type: none"> Degradation of Habitat 	<ul style="list-style-type: none"> Changes in Reproductive Behavior and Rates Changes in Food Sources 	<ul style="list-style-type: none"> Changes in Community Structure—relative abundance of various species Changes in Ecosystem Structure and Function
<ul style="list-style-type: none"> Alteration of Natural Processes—e.g., Hydrology, Species Interactions (e.g., competitor and predator—prey), migration 	<ul style="list-style-type: none"> Altered Energy Flows 	<ul style="list-style-type: none"> Changes in Population Sizes from effects on births, deaths, immigration and emigration Changes in Vegetative Structure 	<ul style="list-style-type: none"> Change in Ecosystem Ability to Support Life

4.2.3.2 Socioeconomic Effects

Encroachment by transportation projects can directly affect the physical nature of a neighborhood in two major ways:

- < alteration of traffic patterns and access
- < relocation of homes, business, or relocation or alteration public facilities

These direct effects can result in indirect effects that can be magnified by the cumulative impacts of other actions. These effects include alterations to:

- < neighborhood cohesion
- < neighborhood stability
- < travel patterns of commuters and shoppers
- < recreation patterns at public facilities
- < pedestrian dependency and mobility
- < perceived quality of the natural environment
- < personal safety and privacy
- < aesthetic and cultural values

These variables should be used to explore effects from changes in the physical environment from transportation projects. For example, a highway project can physically alter the local street network and/or increase traffic volumes on local streets, both of which could effect pedestrian mobility and consequently, interactions and neighborhood satisfaction.

The categorization of effects on the environment presented in Table 13 can be a useful tool for identifying socioeconomic indirect effects. Of particular note on Table 13 is the opportunity-threat category of effects, i.e., those that can occur while a project is planned but before construction. Examples include effects on real estate investment and maintenance of property. Such effects may indicate the long-term indirect effects of a project once implemented.

It is important to note that the ecological and socio-economic encroachment-alteration effects described above can also arise from induced growth which is itself an indirect effect. Induced growth effects are described below.

TABLE III-13
CONCEPTUAL APPROACH TO EFFECT IDENTIFICATION

System Affected	Temporal Phase		
	Opportunity-Threats	Development/Event	Adaptation/Post-Development
Physical	Anticipatory construction or lack of maintenance, decay of existing structures and facilities.	Potential massive alteration of the physical environment, construction of new and upgrading of existing facilities.	Creation of development-specific facilities, deterioration of alternative productive facilities, destruction of environment.
Cultural	Initial contact, new ideas, potential for loss of cultural continuity.	Suspension of activities that assure cultural continuity (e.g., subsistence harvest).	Gradual erosion of culture: loss of unique knowledge, skills, and/or perspectives.
Social	Organizational changes investment of time, money, or energy for support or resistance; differential construction of risk.	Population increase, influx of outsiders: decline in density of acquaintanceship: social change.	Gradual loss of social human capital (e.g., organizational networks and skills, replacements having limited optional application).
Political/Legal	Litigation to force or block proposed development, heightened political claims-making.	Intrusion of development activity into community politics, litigation and conflict over activity impacts.	Zoning and regulatory changes in search of new development, new laws/ruling in response to impacts.
Economic	Decline or increase in property values, speculation, investment.	Traditional boom/bust effects, inflation, entrance of outsiders into local labor market.	Loss of economic flexibility, specialization of business.
Psychological	Anxiety, stress, anger: gains or losses in perceived efficacy.	Stress associated with rapid growth, psycho-social pathology, loss of efficacy.	Acquisition of coping strategies that are potentially maladaptive under future scenarios.

Source: Gramling and Freudenberg, p. 218.

4.3 Techniques for Determining Significance

There are a number of techniques discussed below that could support identification of cause-effect linkages between project impact-causing actions and goals and notable features. The techniques can be used individually or in combination. The techniques involve varying degrees of background research.

- < *Matrices* - A project evaluation matrix is commonly a grid diagram in which two distinct lists are arranged along perpendicular axes, e.g., actions and environmental characteristics. The interaction between actions and their environmental characteristics are noted in the matrix. A weighting of the interactions relative to impact significance is often performed.

While a variety of techniques may be employed to identify indirect effects in addition to matrices, the final product of this step in the framework should be completion of the Evaluation Matrix attached as Table 14 below.

- < *Networks* - Also known as system diagrams, networks can be used in classifying, organizing, and displaying problems, processes, and interactions and to produce a causal analysis of the indirect effects situation. Obviously, the network is only as good as the as the underlying understanding or assumptions of often complex processes and interactions.
- < *Qualitative Inference* - This technique involves a case study description of an area of concern, e.g., habitat or neighborhood, and an identification based on professional judgement of the possible changes that the proposed project would entail. The case study should focus on the elements or indicators that characterize the area of concern using ecological, economic, demographic, or social profile information from baseline investigations. This technique, though practical and simple, has obvious limitations. Foremost among these is slipping into speculation based on limited data or unusual circumstances. Broad participation, including input from local planners on the local real estate market, can help avoid speculation.
- < *Cartographic Techniques* - Specific techniques, like the McHarg overlay (McHarg, 1969), are time-tested. These can be particularly useful for visualizing potential indirect effects related to alteration of the physical environment, e.g., habitat fragmentation or community segmentation. Computerized geographic information systems have greatly enhanced the ability to process and display cartographic information. Cartographic techniques are limited in their ability to reveal the structure, function, and dynamics of areas. However, their utility can be expanded by relating inventoried information about these characteristics via a relational database.

TABLE III-14
EVALUATION MATRIX FOR POTENTIALLY SIGNIFICANT INDIRECT EFFECTS

Indirect Effect Type	Direct Effects from Impact-Causing Activities	Indirect Effects from Direct Effects (List)	Potential Manifestation of Indirect Effects (List)	Link between Indirect Effect and Goal or Notable Feature that Meets Impact Significance Criteria ¹	
				Yes (Go to Step 5)	No (Assessment Complete)
Encroachment-Alteration	Ecosystem-related				
	Socioeconomic-related				
Induced Growth (Access-Alteration)		Serves specific development			
		Stimulates complementary development			
		Influences location decisions			
Effects Related to Induced Growth			Ecosystem-related		
			Socioeconomic-related		

¹ Refer to Tables 15 and 16.

- < *Comparative Case Analysis* - A comparative study involves comparing a like area where a project similar to that proposed has been completed. This technique is described in detail in Section VI below. Care should be taken not to rely exclusively on a comparative case for identification of effects but as a supplement to other techniques.

It is likely that some combination of methods will be needed in most situations to identify the proposed transportation project's indirect effects. This combination would include cartographic techniques for spatial analysis; matrices or networks for visualizing systems' functions and behavior and interconnections with the project; and either qualitative inference or comparative case study to support the visualization. Regardless of the method used, tabulation is necessary to organize the information discerned to date and to make explicit the process used to determine which indirect effects should be carried forward to detailed analysis. Table 14 was prepared for this purpose. Typically, a determination of impact significance includes considerations of impact magnitude and importance. Tables 15 and 16 list considerations that are relevant to indirect effects.

A technical memorandum should be prepared that lists the indirect effects that warrant further analysis, if any, and presents the scope of detailed analysis. The technical memorandum should contain relevant documentation supporting the list of identified indirect effects, e.g., checklists, networks, maps, etc., as well as documentation on those indirect effects considered but dismissed from further analysis by agreement of the involved parties.

TABLE III-15
IMPACT MAGNITUDE CONSIDERATIONS FOR
ASSESSING POTENTIAL SIGNIFICANCE OF INDIRECT AND CUMULATIVE EFFECTS

Encroachment—Alteration Effects

Indicators of significance include when such effects:

- Are wholly or partially within or substantially contiguous to a notable feature (see Step 2)
- and
- Impair the character or quality of important historical, archaeological, architectural or aesthetic resources
- or
- Impair existing community or neighborhood character
- or
- Substantially change the capacity of the environment to support existing uses or functions

Induced Growth and Related Effects

Indicators of significance include when a simultaneous or subsequent action:

- Is likely to be taken as a result of the transportation project
- or
- Is dependent on the transportation project
- and
- Could attract a large number of people to a location compared with existing location attractiveness
- or
- Could cause a substantial adverse change in existing air quality, ground or surface water quality or quantity, energy usage, traffic or noise levels
- or
- Could cause a substantial increase in potential for erosion, flooding, leaching, or drainage problems
- or
- Could cause a substantial change in the use, or intensity of use, of land
- or
- Could cause substantially adverse encroachment alteration effects

TABLE III-16
IMPACT IMPORTANCE CONSIDERATIONS FOR
ASSESSING POTENTIAL SIGNIFICANCE OF INDIRECT AND CUMULATIVE EFFECTS

Context

- Regional consequences
- Potential divergence from local needs and goals

General Considerations

- The need to know about the consequences of a simultaneous or subsequent action now (or the degree to which the decision on the transportation project represents a decision in principle about a simultaneous or subsequent action)
- Probability or confidence that the effect will occur
- Effect duration and irreversibility
- Degree to which the effect can or will be controlled
- Degree of controversy related to the effect
- Whether the effect threatens a violation of federal, state or local law, or requirements imposed for the protection of the environment
- Degree of effect on public health and safety

5.0 ANALYSIS OF INDIRECT AND CUMULATIVE EFFECTS

Once potential indirect and cumulative effects have been identified, those effects meeting the criteria for potential significance,

- < explicit economic development purpose
- < divergence from local needs and goals, and
- < potential to impact notable features of social or natural environment,

require further analysis to more precisely determine issues such as

- < magnitude
- < probability of occurrence,
- < timing and duration, and
- < degree to which the effect can or will be controlled.

Results and methods employed in the analysis should be fully documented in a technical memorandum. This document should also include specific findings regarding the significance of each potential effect. Indirect and cumulative effects still thought to meet the criteria for significance, should receive further consideration regarding consequences and options for avoidance or mitigation.

A variety of quantitative and qualitative tools can be employed in the analysis of indirect and cumulative effects. This section will describe general considerations involved in the analysis, the tools available, and their application in the context of systems planning and project evaluation.

5.1 Considerations

The first step in the analysis of potentially significant indirect and cumulative effects is to assess the potential and magnitude of project-induced growth. Once the level of induced growth has been assessed, impacts on the natural environment arising from development can be evaluated. Encroachment-alteration effects arising from the project itself should also be assessed after induced growth impacts are explored so that these alteration effects can be fully understood in the context of future land uses.

Analyzing induced growth is an exercise in creating and comparing forecasts of future conditions. At least two forecasts are necessary:

- < a Base or No-Action Forecast which describes future conditions in the absence of the project or plan, and
- < an Action Forecast describing conditions in a future point in time following implementation of the project alternative or plan.

These forecasts should be designed to fully consider cumulative effects by including significant past and anticipated actions undertaken by other parties in both the base and project scenarios.

The key in forecasting is an underlying system of logic that can produce reproducible and relatively consistent results regardless of the forecaster. It should be noted that forecasting is not the exact determination and prediction of the future, but the logical extrapolation of likely effects that will occur from known associations among different critical parts of the system (Vlachos, 1976).

As with other steps in the framework, induced development forecasting techniques may be either qualitative or quantitative in nature:

- < Qualitative methods can serve to evaluate the context or overall situation wherever little historical data exist or wherever existing data are questionable or inconsistent.
- < Quantitative methods consist of modeling or the search for causal factors, and extrapolation or emphasis on time series.

Whenever possible, forecasts developed for other purposes by regional planning and transportation agencies should be utilized. Use of established forecasts as control totals or baselines will not only reduce the level of effort required in the assessment but will promote acceptance of the findings.

A variety of qualitative and quantitative methods are described below. More complete descriptions of available methods can be found in Volume II, an evaluation of integrated land use transportation models appears in Appendix A. Examples of how these techniques can be combined and applied to potential planning and project scenarios are addressed in the following sections.

5.2 Methods for Analysis

Qualitative and quantitative techniques for analyzing indirect effects include the following.

- < *Literature Review/Comparative Case Analysis* - Literature searches can reveal information used to build qualitative assessments and scenarios of future conditions. A small but growing literature on indirect and cumulative effects can also point to projects with similar characteristics and locational features allowing for comparative case analysis. When using the effects of a past project to illustrate the potential future effects of a proposed project, care must be taken not to overlook contributing factors exogenous to project conditions, such as regional growth rates or economic conditions.
- < *Scenario Writing* - Scenarios describing a range of potential future outcomes based on reasonable, explicitly stated assumptions can be a very useful tool to assess the potential and magnitude of indirect and cumulative effects. The professional judgement of the analyst, local experts, and stakeholders can be used to form assumptions. Multiple scenarios can be prepared to show the lower and upper bounds of reasonably foreseeable outcomes.
- < *Trend Extrapolation* - Simple extrapolation techniques such as curve fitting can be applied to time-series or cross-sectional quantitative data to predict future conditions. Future baseline estimates of population, employment, housing starts, and other conditions can be predicted using historical data, assuming that conditions underlying these trends are expected to continue. This type of forecasting technique is unnecessary, however, when accepted forecasts have already been developed for the study area for other purposes.

- < *Expert Panel Surveys/Delphi Technique* - Thorough surveys of local experts, stakeholders, and professionals can be invaluable in developing assumptions and assessing future conditions. Survey techniques can include informal conversations; formal inquiry following an instrument administered by mail, phone, or interview; or discussions or meetings of a collaborative task force or expert panel. The most structured consultation method is the Delphi technique, an iterative process that allows a consensus opinion to be developed from the independent assessment of experts. These methods can be modified or used in combination to meet the needs and constraints of the evaluation.
- < *Build-Out/Carrying Capacity Analysis* - Assumptions regarding the consumption of land as various types of land uses are developed can be used to predict future conditions based on the carrying capacity of developable land, or permitted uses and densities of land use regulations. This technique is important in constructing a quantitative baseline forecast or translating the output of population or employment forecast into a land use scenario. The technique is also important for assessing the potential for conflict between local land use regulations and the development pressures that can arise from project-related improvements in accessibility.
- < *Regression/Econometric Techniques* - Multivariate linear regression techniques can be applied to time-series or cross-sectional data to predict future No Action conditions and conditions resulting from project alternatives. By determining the relationship between population and employment growth, and factors such as accessibility and location attractiveness, the analyst can predict future baseline conditions and then change the accessibility variable to predict the impact of project-related transportation time savings.
- < *Gravity Models* - This technique allows the analyst to allocate study area population and employment control totals to smaller analysis zones (i.e., TAZs) based on available land, accessibility to other zones, and other measures of attractiveness. When improvements in accessibility arising from the project are factored into the equation, changes in the allocations can be analyzed. Although less sophisticated than formal land use models, this technique can provide quantitative findings to support qualitative scenario writing or survey efforts.
- < *Integrated Land Use Transportation Models* - These models allow analysts to predict land use futures given a wide range of project and policy considerations. Highly quantitative and often complex, the models require significant data and analyst resources. The models are often used by agencies for system-wide analysis, however, and output data or the model itself may be adapted for use in analyzing a particular project or study area.

6.0 Mitigation

6.1 Responsibilities

Mitigation responsibilities specifically focus on the implications of a United States Supreme Court case, *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332 (1989). The questions are (1) is the *Robertson* case applicable and is there any other case law on this issue? (2) Is mitigation of cumulative or indirect impacts required? This memorandum will attempt to answer these questions. However, please note that this is an advisory memorandum. It has not been reviewed and approved in accordance with procedures for issuing an Attorney General's opinion.

In *Robertson*, the Forest Service issued an EIS with the stated purpose of providing "the information required to evaluate the potential for skiing" at Sandy Butte, owned by the Forest Service. *Id.* at 338. The Forest Service had received an application by a company to develop 3900 acres of Sandy Butte and an additional 1165 acre adjacent parcel, already owned by the company. *Id.*

The EIS evaluated five alternatives, ranging from the "no build" alternative to development of a ski area that could accommodate 10,500 skiers. *Id.* at 339. The EIS concluded that "the off-site development of private land under all five alternatives -- including the 'no build' alternative -- 'will have a significant effect on air quality during severe meteorological inversion periods.'" *Id.* at 340. The EIS also noted that "the off-site effect of the development 'would noticeably reduce numbers of deer in the Methow [Valley] with any alternative.'" *Id.* at 343.

The EIS further "identified actions that could be taken by the county government to mitigate the adverse effects of development [on air-quality], as well as those that the Forest Service itself could implement at the construction stage of the project," *id.* at 340, and also "described both on-site and off-site mitigation measures" to lessen the impact on the deer population, *id.* at 343. The adequacy of the mitigation discussion and implementation was challenged by a local group.

The Supreme Court held that "NEPA and CEQ regulations require detailed analysis of both on-site and off-site mitigation measures," citing 40 C.F.R. § 1502.16(b). *Id.* at 358. The Court stressed, however, that while "mitigation [must] be discussed in sufficient detail to ensure that environmental consequences have been fairly evaluated," NEPA contains no "substantive requirement that a complete mitigation plan be actually formulated and adopted." *Id.* at 350. In other words, the Supreme Court emphasized that discussion of possible mitigation for reasonably foreseeable impacts is just another part of the procedural "hard look" analysis required by NEPA. The Court thus upheld the Forest Service's discussion of mitigation.

There have been no other Supreme Court opinions on this issue. However, other federal courts have since addressed the issue and fleshed out the mitigation requirements.

A mitigation plan "need not be legally enforceable, funded or even in final form to comply with NEPA's procedural requirements." We need only be satisfied that the agency took the requisite "hard look" at the possible mitigating measures; but, on the other hand, a "perfunctory description" is not adequate to satisfy NEPA's requirements. A "mere listing" of mitigating measures, without supporting analytical data, also is inadequate.

Okanogan Highlands Alliance v. Williams, 236 F.3d 468 (9th Cir. 2000) (citations omitted). These mitigation requirements appear to apply to mitigation of both direct and indirect or cumulative impacts. See *National Parks & Conservation Ass'n v. United States DOT*, 222 F.3d 677 (9th Cir. 2000) (applying similar analysis and finding that EIS contained adequate discussion of mitigation of cumulative impacts from introduction of alien species).

In the only 4th Circuit opinion on point, the court was asked to decide whether an EIS should have included the costs of mitigation proposed in the EIS to abate noise resulting from expansion of a naval operation. *Citizens v. Dalton*, 2000 U.S. App. Lexis 17422 (4th Cir.). The court found it was not arbitrary and capricious for the Navy to exclude the exact cost of mitigation from the EIS where the document noted costs would be significant and where the Navy had no authority to spend federal money on non-federal property improvements to abate noise.

It is unclear from the case law how detailed the discussion of mitigation must be. CEQ has provided some guidance on the scope of the mitigation analysis in its "Forty Questions" document. This discussion is applicable to mitigation of both direct and indirect or cumulative impacts.²

19a. Mitigation Measures. What is the scope of mitigation measures that must be discussed?

A. The mitigation measures discussed in an EIS must cover the range of impacts of the proposal. The measures must include such things as design alternatives that would decrease pollution emissions, construction impacts, esthetic intrusion, as well as relocation assistance, possible land use controls that could be enacted, and other possible efforts. Mitigation measures must be considered even for impacts that by themselves would not be considered "significant." Once the proposal itself is considered as a whole to have significant effects, all of its specific effects on the environment (whether or not "significant") must be considered, and mitigation measures must be developed where it is feasible to do so. Sections 1502.14(f), 1502.16(h), 1508.14.

19b. How should an EIS treat the subject of available mitigation measures that are (1) outside the jurisdiction of the lead or cooperating agencies, or (2) unlikely to be adopted or enforced by the responsible agency?

A. All relevant, reasonable mitigation measures that could improve the project are to be identified, even if they are outside the jurisdiction of the lead agency or the cooperating agencies, and thus would not be committed as part of the RODs of these agencies. Sections 1502.16(h), 1505.2(c). This will serve to alert agencies or officials who can implement these extra measures, and will encourage them to do so. Because the EIS is the most comprehensive environmental document, it is an ideal vehicle in which to lay out not only the full range of environmental impacts but also the full spectrum of appropriate mitigation.

²"Impacts" are defined in CEQ's regulations to be synonymous with "effects," which includes both direct and indirect effects. 40 C.F.R. § 1508.8.

However, to ensure that environmental effects of a proposed action are fairly assessed, the probability of the mitigation measures being implemented must also be discussed. Thus the EIS and the Record of Decision should indicate the likelihood that such measures will be adopted or enforced by the responsible agencies. Sections 1502.16(h), 1505.2. If there is a history of nonenforcement or opposition to such measures, the EIS and Record of Decision should acknowledge such opposition or nonenforcement. If the necessary mitigation measures will not be ready for a long period of time, this fact, of course, should also be recognized.

Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations, 46 Fed. Reg. 18026 (1981).

In sum, the EIS must address mitigation of cumulative or indirect impacts "in sufficient detail to ensure that environmental consequences have been fairly evaluated." *Robertson*, 490 U.S. at 352. This includes mitigation that could only be undertaken by entities other than the agency preparing the EIS. The agency must only describe such mitigation possibilities; it does not have to actually implement them itself or receive commitments from other organizations (such as local governments) to implement them.³

6.2 Mitigation Considerations

- **General mitigation considerations** based on impact assessment (direct, indirect or cumulative)
 - < to proceed with the project, as proposed; or
 - < to formulate a revised project; or
 - < to otherwise mitigate adverse effects associated with the proposed project
- **Specific mitigation considerations** for indirect and cumulative effects (project-by-project basis)
 - < Is mitigation relevant decision on the project?
 - < Are the effects significant?
 - < Are there practicable mitigation measures?
 - < Are mitigation measures within the jurisdiction of the sponsoring agency? Can the agency practicably control the impact and does it have a continuing program responsibility over the impact?

³Though mitigation of cumulative/indirect effects is not required, FHWA has indicated that it may provide funding for such mitigation. See *Position Paper: Secondary and Cumulative Impact Assessment in the Highway Project Development Process*, Federal Highway Administration Project Development Branch, HEP-31 (April 1992) (available at http://www.fhwa.dot.gov/environment/nepa/2_c_imp.htm); see also 23 C.F.R. 771.105(d).

- < What is the sponsoring agency's role when mitigation measures are not within its jurisdiction?

6.3 Possible Mitigation Techniques for Indirect and Cumulative Impacts

6.3.1 Possible Measures Implementable by NCDOT

- < Comprehensive Performance Measures
- < Promoting Regional Coordination
- < Access Controls
- < Context Sensitive Design

6.3.2 Possible Measures Implementable by Municipal Governments

- < Zoning/Comprehensive Planning
- < Growth Management Regulation
 - < Adequate Public Facilities Ordinances (APFOs)
 - < Development Moratoria
 - < Urban Growth Boundaries
 - < Extraterritorial Zoning/Annexation
- < Resource Management and Preservation Regulations
 - < Coastal zone management areas
 - < Watershed management areas
 - < Stream corridors
 - < Special area management plans
- < Land Acquisition/Conservation Easements
- < Incentives for Brownfield/Infill Development
- < Development Fees and Exactions

**APPENDIX A:
REVIEW OF INTEGRATED LAND USE AND
TRANSPORTATION MODELS**

Integrated Land Use and Transportation Models

Transportation planners have long relied upon computer based models to predict how traffic patterns change with improvements to the transportation system. In the last two decades, there have been an increasing number of models that also predict the indirect land use effects of transportation projects—land development and the location of households and employers. To properly simulate the relationship between land use and transportation, integrated models are required. These models predict how changes in accessibility influence changes in location and how the congestion created by relocated households and businesses, in turn, affects accessibility. Several approaches have been employed to simulate locational decisions but it is the feedback between the transportation and land use components of these models that make them integrated and useful in the analysis of indirect/cumulative effects.

Since the early 1990s, computer modeling of land use patterns has become more sophisticated. In recent years, developers have undertaken improvements in the feedback loop between travel demand and land use components, have improved the process of calibration, and have added Geographic Information System software as a graphical interface for data input and output. Even the more complex computerized models now run quickly on standard desktop computers. This increased sophistication and improved usability has contributed to wider use of models at state agencies and MPOs.

A 1995 study described the results of a survey of model use at MPOs in the thirty-five largest metropolitan areas. Eighteen of the thirty-five employed or were planning to employ modeling techniques at the time of the survey: twelve indicated that they use one of the models discussed below (DRAM-EMPAL); another six have developed or are developing their own models. The remaining MPOs employed qualitative techniques including the Delphi method to allocate forecasted population and employment. (Porter, 1995)

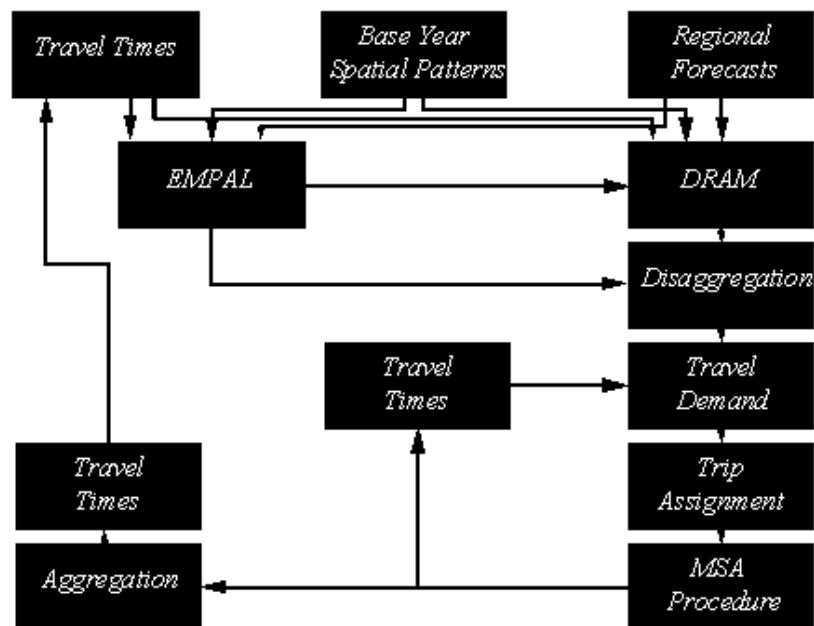
This section examines integrated land use and transportation models that are currently available for implementation. Several reviews of formal land use models and their integration with travel models have been published in recent years. This section is based in large part upon three recently published reviews: *Land Use Impacts of Transportation: A Guidebook* (NCHRP Report 423A, 1999); *Review of Land Use Models and Recommended Model for DVRPC* (Oryani and Harris, 1996); and “Operational Urban Models: State of the Art” (Wegener, 1994). Several other papers have been published on the importance and utility of transportation/land use modeling and are cited below. A full list of references appears at the end of the section.

ITLUP (DRAM/EMPAL)

Developed in the 1970s by University of Pennsylvania's Steven H. Putman under contract with the U.S. Department of Transportation, the Integrated Transportation and Land Use Package (ITLUP) is the most widely used model for land use forecasting among transportation agencies. Due to its data and time intensive nature however, it is most often employed by larger agencies.

ITLUP forecasts population growth and household location in zones based on the Lowry gravity-model method. The software consists of two major submodels: DRAM and EMPAL. DRAM (Disaggregated Residential Allocation Model) estimates household location by household type (income quartiles) in relation to employment locations in a future year and the probability of work trips between zones in that year. Travel between zones is based on transportation impedance (time or cost) and a measure of attractiveness for each zone based on the availability of land, the percentage of households by income quartiles, and the location of employment. The location of employment can be derived through EMPAL (Employment Allocation Model) or through assumptions made outside the model. Another submodel, LANDCON calculates the consumption of land associated with the household and employment forecasts. Model calibration is achieved through an automated program (CALIB) that estimates equation coefficients and provides goodness-of-fit statistics, asymptotic t-tests for the statistical significance of the coefficients, and point elasticities for sensitivity analysis. (DVRPC, 1996)

Structure of ITLUP



Source: Oryani & Harris, 1996

Travel models provide the input for zone to zone travel impedance and ITLUP is capable of interfacing with all the major travel model packages in use today, including TRANPLAN, EMM/2, and MINUTP. The model can also be adapted to read any travel impedance matrix generated by custom packages. Through its interface with travel models, ITLUP allows users to estimate the induced land use impacts of transportation improvement projects. ITLUP can be run for several different improvement scenarios, showing the impact of zone to zone accessibility changes on the location of employment and households. Outputs from ITLUP can also be fed back into travel models in an iterative fashion to create an integrated model of the transportation/land-use interaction.

Data Required

Inputs to the model are ideally provided on the level of Traffic Analysis Zones (TAZs) and include base year and historical data on employment, households, land consumption, and travel impedance as follows.

By Zone:

- < Employment by type (1-digit level SIC) for base year and one previous period
- < Households by income quartiles for base year and one previous period
- < Total land area
- < Land area by use category (residential, industrial, commercial)
- < Vacant developable land
- < A zonal travel impedance matrix (travel time or cost from travel model)

For study area:

- 5) Control totals for households and employment in 5-year intervals for forecast period.

Advantages

- < Data requirements match data maintained in most jurisdictions.
- < Compatible with outputs from standard travel models.
- < Long history of successful adaptations, substantial literature/knowledge base on application.

Disadvantages

- < Involves high level of effort and substantial commitment of time and resources.
- < Lacks representation of the land market clearing process (this will be a component of a model revision called METROPILUS, see below).
- < Simplifies the relationship between employment and household generation and does not account for important household demographic characteristics shown to affect location choices such as household structure (number of children and workers), and ethnicity.

- < Cannot address changes in policy alternatives such as land use regulations, economic development strategies, or major infrastructure improvements.
- < Initial runs of the model have been known to produce unreasonable forecasts requiring manual intervention with adjustment of calibration residuals and constraints. The lack of standardized procedures for these adjustments leave open the possibility for the introduction of error.

Pending Revision

Putman has announced that ITLUP is in the process of being replaced with a more comprehensive package called METROPILUS. Active users of ITLUP will be upgraded to the new package when it becomes available. METROPILUS will be based on the location surplus notion and will integrate employment location, residential location, and land consumption in a single package. The addition of land value (relative housing prices or a multivariate index) as an attractiveness measure is another planned feature. The model will interface with ARCVIEW GIS software (ESRI) for input, output, and some statistical routines (DVRPC, 1996).

Requirements for Implementation

Licensing: Consulting contract packages range from \$15,000 to \$100,000 depending on scale of implementation.

Platform: Mainframe, DOS, Windows, UNIX.

Staffing: teams vary in size and expertise depending on scale and consulting services usually one senior-level and one junior-level staffer.

Consulting for implementation and calibration available.

MEPLAN

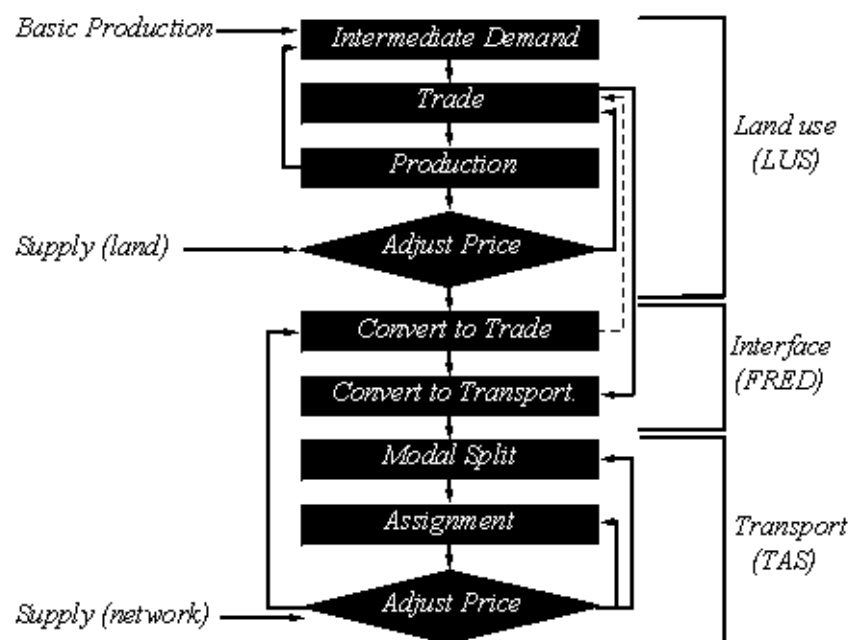
The MEPLAN model developed and refined over the last thirty years by Marcial Echinique and others is also based on the Lowry-gravity model principle but includes components of economic theory, such as input-output modeling, discrete choice analysis, and random utility theory, that are not part of the standard Lowry construction.

The core function of the model is to determine land consumption in and among zones by linking supply and demand for space, transport, and factors of production such as labor. Employment markets are modeled using input-output techniques to determine industrial composition and inter-industry flows. Employment in base industries, those industries dependent on exogenous export-driven demand, is determined. Basic employment drives demand for housing and non- base industries such as retail and services.

Random utility theory is employed in the allocation of industries and households to zones firms and households are assumed in this model to act in a utility-maximizing and cost-minimizing way. The model attempts to approximate market mechanisms by calculating elasticities in demand with the respect to the prices of land, floorspace, labor, and travel. In this way, the location choices of employers and households are based not only on the time cost of travel (the effect of congestion on the network) as in other models, but the price of land.

The input-output methodology allows for demand for the transport of goods between zones to be modeled in addition to the work and non-work trips of household members. Person-trips and commodity flows between zone are distributed across modes and routes using an iterative multi-path assignment techniques common to transportation demand models.

Structure of MEPLAN



MEPLAN consists of three submodels and an evaluation chapter. LUS is the regional/urban land use and economic model which estimates the demand for inputs to basic production in zones. FRED is an interface program that converts demand for production inputs at the zonal level to flows of goods and people. The TAS submodel distributes these flows across modes and routes in the network. The model is typically run in 5-year increments over a 20+ year study period to achieve a balance between the land use and transportation components. The effects of changes in prices and accessibility are lagged to approximate the real world constraint of imperfect information and the non-instantaneous nature of location change. The evaluation chapter, EVAL, allows for the assessment of the land use and transportation effects of a project through cost-benefit analysis of policy scenarios in comparison with a base case. The model's reliance on market mechanisms makes it particularly suitable for evaluating policy changes that result in changes in price or supply of production inputs. Examples include the effects of increases in parking charges, public transportation fares, and tolls.

Data Required

Inputs to the model are provided on a zonal level. It may be necessary for the zones to be aggregations of Traffic Analysis Zones (TAZs) if the economic data is not available at the proper level of detail. Data required to run the model include:

- < Land use and land prices (by sector)
- < Floorspace and prices (by sector)
- < Population (by household type)
- < Employment (by sector)
- < Input-Output tables (user-determined sector aggregation)
- < Exogenous forecast of basic employment
- < Transportation network (by mode)

Additional data by zone and economic sector is required for calibration:

- < Exogenous production
- < Induced production
- < Unit production prices
- < Valued added to each unit of production
- < Exports and Imports
- < Restrictions to internal production

Advantages

- < Fully incorporates market functions and the pricing factors of production and transportation for a closer approximation to the theoretical understanding of real world mechanisms.

- < Allows for evaluation of a wide range of user-defined policy scenarios affecting supply, or pricing of transportation/production factors.
- < MEPLAN allows for flexibility in the spatial level of analysis, making amenable to data constraints.

Disadvantages

- < Substantial data requirements including detailed regional economic data not normally collected or manipulated by transportation planners.
- < Calibration is a detailed process often requiring developer assistance. The calibration process may have limited utility because it is largely cross-sectional in nature.
- < Model's reliance on input-output data makes it more suitable to intra-regional studies rather than intra-urban applications. It may be difficult to accurately disaggregate input-output data to the small TAZs seen in urban areas. Beyond the problem of disaggregation, if only a few industry sectors are represented in small urban TAZs, the functioning and accuracy of the model maybe compromised.
- < No method for linking with commonly used travel demand models since MEPLAN contains its own travel demand component.

MEPLAN has been limited to one application in the United States: an academic exercise for the Sacramento, California region.

Requirements for Implementation

Licensing: approximately \$40,000 for full package of chapters

Platform: DOS, Windows, and UNIX S

Staffing: team consisting of a planner, transportation engineer, and economist

Consulting for implementation and calibration available.

TRANUS

TRANUS and MEPLAN are based on the same theoretical framework differing little in basic structure or data requirements. TRANUS make greater use of logit-based formulations for mode and route choice.

TRANUS has also been applied to the Sacramento in an academic project and is currently in use by the Oregon Department of Transportation in their statewide modeling effort undertaken in the late 1990s.

Requirements for Implementation

Licensing: \$6,000

Platform: Windows 95

Staffing: team consisting of a planner, transportation engineer, and economist

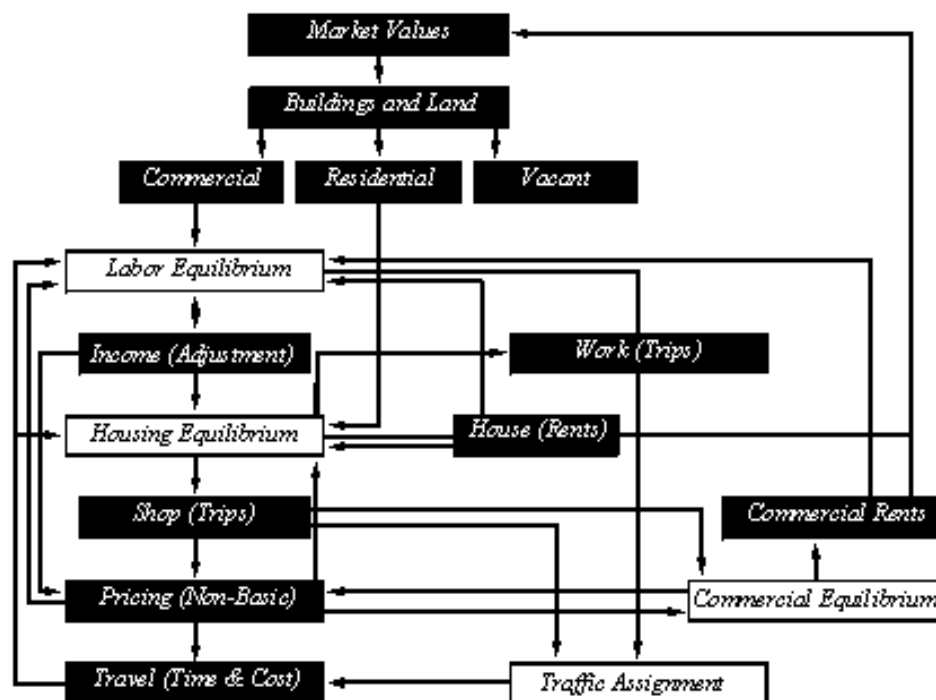
Consulting for implementation and calibration available.

METROSIM

The METROSIM model is a discrete choice model of housing location developed by Alex Anas at the State University of New York at Buffalo. The model has been adapted for several specific regional applications: CATLAS for the Chicago area (residential location, housing, and mode choice), CPHMM a prototype dynamic housing market model for Chicago, Houston, Pittsburgh, and San Diego MSAs, and a NYSIM which modeled housing location, work and non-work travel, and commercial real estate markets for the New York Metro area MPO.

As with MEPLAN and TRANUS, METROSIM takes an economic market based approach to residential and employment location. METROSIM is not, however based on the Lowry gravity model formulation. The model is made up of several submodels estimating activity in basic industry, non-basic industry, households, residential and commercial real estate, vacant land, travel demand, and traffic assignment. A simultaneous equation system is used achieve equilibrium in three market sectors: labor market and employment location, housing market, commercial space. The model iterates between the interactions of the three markets and the transportation network until an overall equilibrium state between land use patterns and transportation flows is achieved. The model can produce either one long-run steady state equilibrium forecast or an incremental set of forecasts on an annual basis.

Structure of METROSIM



Source: Oryani & Harris, 1996

Calibration is cross-sectional, dependent upon one base year, employing econometric techniques. The functioning of the model and the calibration is complex and requires the direct involvement of the developer.

Data Required

- < Census Transportation Planning Package (CTPP, Urban Elements 1, 2, and 3)
- < Transportation network (by mode)
- < Data on real estate parcel characteristics and values

Advantages

- < Minimal data requirements, data is available and familiar to transportation planners.
- < Every aspect of the model is rigorously grounded in economic theory making one of the most theoretically consistent integrated models.

Disadvantages

- < Complexity of model requires participation of developer.
- < The model's assumption of equilibrium, perfect information, and the immediate adjustment of all households and businesses within each time period are not consistent with real-world conditions.
- < The model is based on one-worker households. An adjustment for the multi-worker households common today is possible but undermines the structure of the nested choice structure of the model.
- < METROSIM is calibrated cross-sectionally with little history of long-term validation.

Requirements for Implementation

Licensing: not distributed commercially, use by arrangement with developer

Platform: UNIX workstation only

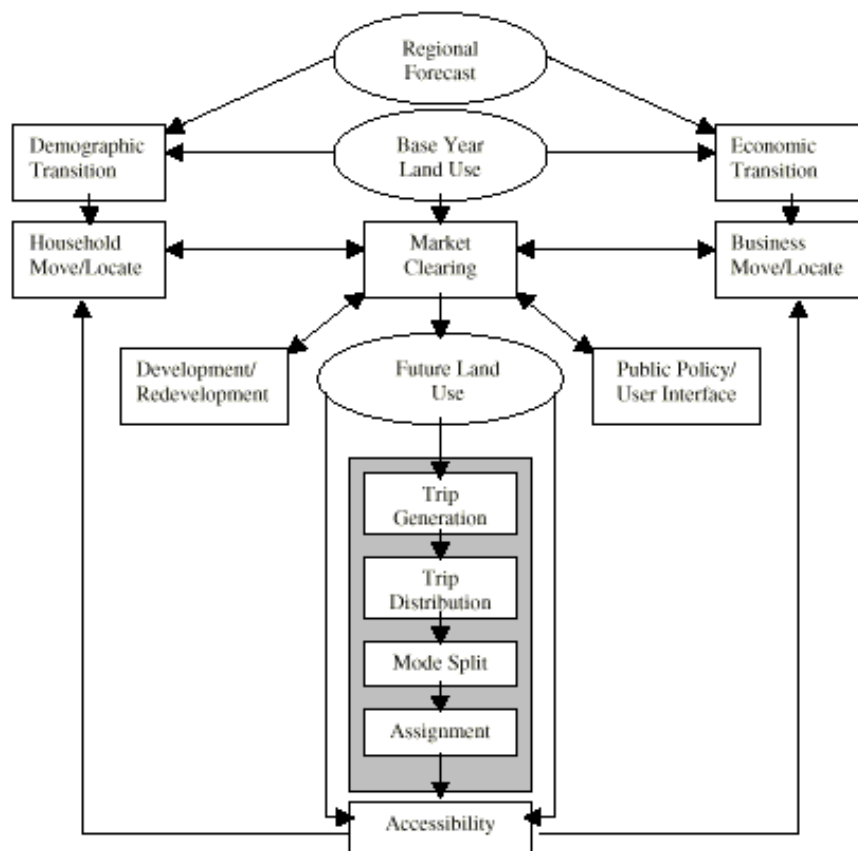
Staffing: estimates should be obtained from developer

UrbanSim

UrbanSim, one of the most recently developed integrated land use and transportation models, was created in the late 1990s by Paul Waddell and a team from the University of Washington under contract to Parsons Brinkerhoff. The development of UrbanSim has been funded by the Oregon Department of Transportation, and the National Cooperative Highway Research Program, with subsequent funding from the State of Utah Governor's Office.

UrbanSim contains two categories of decision-makers and choices influencing urban development: endogenous and exogenous. The decisions made by households, workers, businesses, and developers are endogenously modeled, and the decisions made by the public sector are treated as exogenous, and are input to the model in the form of policy scenarios. The design of treating urban development as an interaction between market behavior and governmental actions is intended to maximize the realism of the model as well as its utility for assessing the impacts of alternative governmental plans and policies related to land use and transportation.

Structure of UrbanSim



Source: Waddell

The model endogenously predicts the location of businesses and households; the location, type, and quantity of new construction and redevelopment by developers; and prices of land and buildings. A household mobility and location submodel simulates the household decision to stay or move in a given year and predicts housing type and location if a move is undertaken. Multinomial or nested logit estimation techniques are used to model household behavior in a manner similar to the modeling of mode choice in travel demand models. Price and accessibility are among the factors influencing locational choice. A business location submodel also uses logit functions to distribute business among zones in each year of the model run.

The simulation of development decisions to convert vacant or developed land to other uses is based on calculations of demand and development profitability carried out by a development submodel. Infrastructure availability and government constraints such as zoning, growth boundaries or impact fees can also be factored into the development decision making process.

UrbanSim produces results based on adjustments in prices, land availability, and accessibility on a yearly basis for the entire study period. The model user defines time periods for recalculation of travel costs and congestion using a travel demand model (TRANPLAN, EMME/2, MINUTP) external to UrbanSim. The travel demand model can be run at regular intervals or to incorporate changes anticipated by the completion of major facilities or improvements.

Calibration is performed using historical time-series data in multiple regression analyses to estimate bid price functions for different household groups. Outside statistical software used for regression (SAS, SPSS). Logit estimation using outside package (Limdep, Alogit) also necessary. Validation with known data for historical periods can also be conducted with model runs.

Data Required

- < Regional control totals for population and employment
- < Household characteristics (Census STF3 and PUMS)
- < Existing land use (at parcel level, usually GIS input)
- < Land use plans (compatible with parcel-level GIS)
- < Infrastructure plans (compatible with parcel-level GIS)
- < Environmental constraints (compatible with parcel-level GIS)
- < Regional development costs (by land use type)
- < Government regulations (impact fees, tax abatements)
- < Travel cost matrix (from external travel demand model)

Advantages

- < No licensing fee for use and designed for any microcomputer platform capable of running Java (Windows, MacOS, Unix).
- < Provides results based on market mechanisms and policy constraints at a high level of spatial disaggregation (TAZ).
- < Explicitly accounts for use of land, and characteristics of households and businesses in yearly time periods. Accounts for new development and redevelopment.
- < Capable of modeling impacts of land use and other government policy scenarios.
- < Compatible with existing travel demand models and transportation planning data.
- < Data output to built-in GIS reader for mapped results.

Disadvantages

- < Newly developed software does not have track record of practical applications, calibration, and validation.
- < Substantial data requirements including parcel level data on land use, vacant land, environmental constraints, and infrastructure availability. Requires GIS expertise and careful preparation of data of a level and type not normally utilized by transportation professionals.

Pending Revision

According to the UrbanSim web page, the model is being reworked to fix bugs and accommodate recent improvements. The new version will be available for free download in Fall 2000. Previous versions are not available and the developer recommends against their use.

Requirements for Implementation

Licensing: no fee; free for download (www.urbansim.org)

Platform: DOS, Windows, MacOS and UNIX (requires free Java Developers Package)

Staffing: travel modeler, land use planner, GIS analysts

Contact developer for information on consulting for implementation and calibration.

Other Operational Models

Several MPOs have developed in-house land use and transportation models to meet their forecasting needs. One example is:

POLIS (Projective Optimization Land Use Information System) developed by Poulicos Prastacos for the Association of Bay Area Governments, is a mathematical programming formulation of the Lowry model. The model is based on random utility theory. Basic employment and travel impedance are exogenous to the model. Similar in function, data requirements, and output to ITLUP.

There are a few examples of models that are not fully integrated transportation and land use models but contain components that may be useful those studying the indirect/cumulative effects of transportation projects:

CUF (California Urban Futures) – Developed by John Landis at the University of California at Berkeley, CUF operates entirely within the ArcInfo GIS platform. Although the model is a large scale metropolitan simulation model, it cannot be integrated with travel demand models and does not include travel cost considerations—it would not therefore be useful on its own for modeling transportation improvement alternatives. It does allow for modeling of land use policy alternatives and provides bottom-up population and household projections and residential land consumption predictions.

TELUS (Transportation, Economic, and Land Use System) – Developed for the North Jersey Transportation Planning Authority (NJTPA) by a team from the New Jersey Institute of Technology and Rutgers University, TELUS is a transportation management software tool. The software combines a database of projects in the Transportation Improvement Plan (TIP) with the capability to translate the cost of improvement projects into economic impacts for the 13-county region covered by the MPO. TELUS is also designed to measure the change in property values related to transportation investment projects and changes in accessibility. Property value impacts are measured using a comparison between similar projects and communities, and a multiple regression model (covering the period 1990-2000) describing the relationship between the cost of improvements and changes in property values.

SCALDS (Social Cost of Alternative Land Development Scenarios) – The SCALDS model was developed in 1998 by Parsons Brinkerhoff Quade & Douglas, Inc. for FHWA. The model is not a fully calibrated land use and transportation model. It is, however, a comprehensive accounting framework for evaluating many of the most important costs and benefits associated with transportation systems and related land development. The model would be useful in evaluating the impacts of a variety of land use and growth scenarios developed on the regional level. The model does not provide forecasts of induced growth or allocation of projected development to sub-regional zones. The model has three main calculation paths:

- < *Physical Development* - This portion of the model estimates consumption of land; the projected mixture of new housing units; local infrastructure cost; the annual operating cost of sewers, water, and storm water; and the average amount of non-residential building space needed to support new development. A short term projection of school children and school costs is also provided. These outputs are based on growth forecasts generated by MPOs or other regional entities that are exogenous to the model. The growth forecasts include projections of population, households, housing units, vacancy rate, employment, and vehicle miles traveled (VMT), aggregated at the regional level.
- < *Travel Cost* - This path models the annual operating cost of peak and non-peak travel on a passenger miles traveled (PMT) basis. Person trips are derived from household estimates and the average number of trips per household. Trips are allocated to modes based on the percentage of trips made by vehicle type and PMT is calculated from these figures. Costs per passenger mile are then estimated based on depreciation and financing, insurance, registration, fuel, maintenance, transit, parking, and value of travel time costs.
- < *Air Pollution and Energy Consumption* - This portion of the model estimates air pollution by transport mode, and energy consumption by transportation and residential and non-residential land uses. The model uses accepted national estimates derived from recent literature. Locally developed estimates or inputs from other modeling estimates may be substituted.

Further information on the SCALDS model and a complete copy of the Microsoft Excel spreadsheet model is available through the FHWA website (<http://www.fhwa.dot.gov/scalds/scalds.htm>).

Smart Growth INDEX – This GIS-based sketch planning tool was prepared by Criterion Planners in 1999 for the U.S. EPA. The model offers evaluation of alternative growth scenarios, land-use plans, and urban design features for consistency with community goals and policies. Smart Growth INDEX employs a gravity model formulation to allocate exogenous regional population forecasts to sub-regional zones based on user-selected policy constraints and incentives. The model is designed to score the results of land use scenarios against a set of performance indicators. The model is also capable of scoring a micro-level land use plan or urban design with another set of environmental performance indicators. An abbreviated four-step travel demand sub-model is a component of the model but input from an external travel demand model such as TRANSCAD or MINUTP is also acceptable. Data required by the model in ESRI (ArcView) shapefile format includes existing housing by type, road network (street centerlines by functional class), employment count and location, and current or proposed land-use plan designations. Features constraining urbanization such as steep slopes, flood plains, and urban growth boundaries can also be entered into the model in shapefile format.

Outputs of the model include residential density and location, employment density and location, land use mix, jobs/housing ratio, vehicle miles traveled (VMT), travel costs, and air/water quality,

resource use information. The model produces spatial output based on land use cells of a size specified by the user. Land prices are not modeled and it is not possible to change the parameters of the gravity model component.

Smart Growth INDEX offers visual output and sketch-level analysis of the impacts of transportation improvements and land use policies, producing a subregional allocation. Model outputs can be used in support of other analysis techniques described in this chapter. More information on the model is available through the EPA website (<http://www.epa.gov>) or Criterion Planners (<http://www.crit.com>). The model requires ArcView or ArcInfo GIS (ESRI) for operation.

FIGURE A-1: Attributes of Integrated Land Use and Transportation Models

Model	Model Theory	Sectors Modeled	Policies Modeled	Data Required	Level of Aggregation	Platform	Implementation
ITLUP (DRAM/ EMPAL)	Lowry formulation random utility network equilibrium	employment population housing land use travel	land use regulations transportation improvements	employment by industry households by income quartile total land area land area by use category vacant developable land travel cost matrix	TAZs or higher level of aggregation	DOS Windows Unix	\$15K -\$100K complete consulting contract package 2-person plus planning team
MEPLAN	Lowry formulation random utility network equilibrium land use equilibrium	employment population housing land use travel networks workplaces goods transport	land use regulations transportation improvements transportation cost changes	land use and price by sector floor space and price by sector population (by household type) employment by sector input-output tables forecast of basic employment transportation network by mode	Groupings of TAZs	DOS Windows Unix	\$40K complete licensing consulting for implementation/calibration available planner, engineer, economist team
TRANUS	Lowry formulation random utility network equilibrium land use equilibrium	employment population housing land use travel networks workplaces goods transport	land use regulations transportation improvements transportation cost changes	land use and price by sector floor space and price by sector population (by household type) employment by sector input-output tables forecast of basic employment transportation network by mode	Groupings of TAZs	Windows	\$6K complete licensing consulting for implementation/calibration available planner, engineer, economist team
METROSIM	random utility general equilibrium	employment population housing land use travel networks workplaces	transportation improvements	Census Transportation Planning Package (CTTP) transportation network by mode data on real estate values	TAZs or higher level of aggregation	Unix	licensing by arrangement consulting for implementation/calibration required team size varies
UrbansSim	Lowry formulation random utility locational surplus land use equilibrium	employment population housing land use travel workplaces	land use regulations transportation improvements	regional control totals for population and employment households (STF3 and PUMS) parcel land use (GIS) land use regulations (GIS) infrastructure plans (GIS) environmental constraints (GIS) regional development costs government regulations travel cost matrix	TAZs or higher level of aggregation	DOS Windows MacOS Unix (Java Developers Kit)	no cost for downloadable software or documentation consulting not required for use team size varies, must include GIS expertise

Adapted from: Wegener, 1994; NCHRP Report 423A; and Oryani & Harris, 1996

Application of Analysis Techniques

The analysis techniques described above are applicable to a wide variety of systems planning and project evaluation circumstances. The discussion in Chapter 3 on scoping reviewed the issues and considerations involved in selecting methods. After the range of potentially significant indirect/cumulative effects have been identified (see discussion of Step 4 in Chapter 7), the general approach selected at the scoping stage should be reevaluated in light of new information and methods for analysis should be selected. This section provides examples of how the methods discussed in this chapter can be combined to produce a complete analysis of indirect/cumulative effects. Examples are provided for analysis in the context of transportation systems planning and project evaluation under NEPA/SEPA.

Transportation Systems Planning

Although the requirement for a formal Major Investment Study was eliminated with enactment of TEA-21, the Act and subsequent regulations now proposed by FHWA and FTA recognize the importance of considering indirect and cumulative effects in the planning of transportation systems that takes place before the NEPA process. By considering the range of potential indirect and cumulative effects in the evaluation of mode and corridor alternatives the sponsoring agency can better evaluate the broad range of alternatives and lay the ground work for indirect and cumulative effects analysis required by NEPA/SEPA in the evaluation of project alignment and design alternatives.

The assessment of indirect/cumulative effects in the planning phase involves the following considerations:

- < *Induced Growth* - Because details related to alternative selection and design are usually unknown in the planning phase, the focus of the assessment is on the potential for induced growth and related social and ecological effects. Where plans regarding access nodes (e.g., interchanges, stations) are known, consideration can be given to localized induced growth effects and encroachment-alteration effects on notable features.
- < *Link between Land Use Futures and Transportation* - In the planning of transportation systems, future demand for travel is an important consideration. This demand is related, in part, to anticipated growth in population or employment and land use decisions made by those groups. Although these variables are part of Travel Demand Modeling efforts used throughout many urbanized areas to evaluate plan alternatives, there must be specific feedback between transportation and land use systems to adequately evaluate indirect/cumulative effects. Very often a land use scenario is used to determine travel demand but the impact of a transportation system on land use decisions is not explored. This feedback loop is at the heart of induced growth analysis. Feedback is achieved by developing qualitative or quantitative land use scenarios based on the change in accessibility attributable

to each planned alternative. Cumulative effects are addressed by incorporating other actions into the transportation and land use scenarios.

- < *Link between Land Use Futures and the Environment* - The final step in a complete indirect and cumulative effects evaluation at the planning stage is the linking of land use forecasts to notable features in the physical and natural environment. This is most easily accomplished using a cartographic overlay technique or GIS. These methods would allow for graphical representation of potential areas of conflict between the transportation system, anticipated planned and induced development and notable features in the environment in both the planned corridor and surrounding area.
- < *Revising and Updating Analyses* - Indirect and cumulative effects analyses conducted during the planning stage may serve as a good base for the analyses to be conducted in the evaluation of alignment and design impacts. Since significant periods of time often elapse from the evaluation of system plans to the environmental documentation for plan alternatives, however, care should be taken to re-evaluate assumptions in light of the time elapsed and greater knowledge of project details. Encroachment-alteration effects should also be explored as greater detail on project design is revealed. Sensitivity and risk analysis techniques (see Chapter 9) can be valuable tools in exploring the extent to which findings in a forecast change as assumptions change. Survey or expert panel techniques or a rerun of a forecast model could provide update to assumptions that may be required.

The methods described in this chapter can be combined in various ways to analyze indirect/cumulative effects in the planning phase. Options in methodology include but are not limited to the following examples.

Example 1:

- < Use survey of experts, consultation with local planners, or local/county comprehensive plans to develop base forecast of population, employment, and land uses for groupings of TAZs or other subregional level of analysis
- < Use survey or panel consultation techniques to develop criteria for reallocation of population/employment/land uses to subregional areas in the vicinity of a transportation corridor to be improved. Reallocation should be considered for each plan alternative.
- < Map base and action alternative forecasts along with key environmental features drawn from existing secondary sources to reveal areas of potential social or ecological impact.
- < Using findings from mapping exercise, consultation techniques, and literature/comparative case review to write scenarios for base and alternative forecasts. Compare scenarios to each other and significance criteria to draw general conclusions about impacts.

Example 2:

- < Use a gravity model to allocate study area population and employment control totals to groupings of TAZs based on calculation of land available for development in each group and accessibility to other groups in the study area. Accessibility is calculated from zone-to-zone travel times produced by a Travel Demand Model (TDM) aggregated to the TAZ group level.
- < Repeat the gravity model exercise for each plan alternative with new accessibility factors derived from runs of the Travel Demand Model including the mode or corridor alternative.
- < Map base and action alternative forecasts derived from gravity model runs along with key environmental features drawn from existing secondary sources to reveal areas of potential social or ecological impact.
- < Using findings from mapping exercise, and supplementary consultation techniques, and literature/comparative case review to write scenarios for base and alternative forecasts. Compare scenarios to each other and significance criteria to draw general conclusions about impacts.

Example 3:

- < Employ an integrated Transportation-Land Use Model that uses TDM files for travel time input. The model will be run several times to examine each possible combination of transportation and policy alternatives. The model will be based on exogenously determined control totals and will be calibrated based on historical data and the professional judgement of agency analysts and local experts.
- < Model output can be mapped using standard cartographic or GIS techniques along with key environmental features drawn from existing secondary sources to reveal areas of potential social or ecological impact.
- < Using findings from mapping exercise, and supplementary consultation techniques, and literature/comparative case review to write scenarios for base and alternative forecasts. Compare scenarios to each other and significance criteria to draw general conclusions about impacts.

Project Evaluation

The methods employed in the analysis of project alternatives for NEPA are similar to those employed in the planning phase. Since project characteristics and circumstances are more refined however, the techniques, particularly the quantitative methods can be employed at a greater level of detail. Examples of how techniques can be combined to conduct analyses are given below for two possible scenarios—a scenario requiring basic techniques and one requiring a more detailed analysis. Tools should be tailored for the particular project circumstances, and level of information and resources available.

Example 1 - Basic Analysis Techniques:

The addition of an interchange to a limited access highway in a low-growth rural location is expected to have minimal potential for induced growth. To assess the induced growth potential and predict its magnitude the analyst would:

- < Use simple trend extrapolation techniques to produce baseline study area projections of population and employment for the 20-year assessment period. (This was necessary because the county planning office had not conducted forecasts for the area.) Analyst writes uses data to develop a “No Action Scenario” describing future conditions without the improvement.
- < Cite literature showing that interchanges in rural areas far removed from the urban core or employment centers are likely to induce only limited highway oriented development like service stations and convenience stores in quadrants nearest to oncoming traffic.
- < Cite the limited nature of development following a similar project in an adjacent county 10 years ago.
- < Write a scenario describing potential impacts from the conversion of a vacant parcel and several acres of nearby farmland to use by two gas stations, a convenience store, and a restaurant attracted to serve traffic using the new interchange. Analyst concludes that this scenario describes the lower boundary of reasonably foreseeable induced growth.
- < Write a scenario describing impacts arising from the construction of a large truck stop, a hotel, and several fast food restaurants. This scenario details the highest magnitude of growth that is reasonably foreseeable given assumptions established by the analyst.

Example 2 - Detailed Analysis Techniques:

A beltway in high-growth rural and suburban fringe location is anticipated to create opportunities for commercial and residential development involving the conversion of agricultural and forest land. To gauge the impact that the new facility will have on the pace and location of development in the study area the analyst would:

- < Develop a general No Action Scenario for the study area based on 20-year growth projections furnished by the local Metropolitan Planning Organization (MPO).
- < Use a gravity model to allocate study area population and employment control totals to TAZs based on calculation of land available for development in each zone and accessibility to other zones. Accessibility is calculated from zone-to-zone travel times produced by a Travel Demand Model (TDM) used previously by the MPO. At the end of the process the No Action Scenario is refined to describe future development on the TAZ level.
- < Repeat the gravity model analysis for every project alternative based on changes in zone-to-zone travel time produced by a TDM analysis of project alternatives conducted by the MPO previously to evaluate project feasibility.
- < Calculate land consumed in each TAZ by population and employment growth and maps the findings on the GIS maps created to show existing conditions. This analysis reveals potential areas of conflict with the natural environment (induced-growth related impacts) and current land use regulations.
- < Compare gravity model findings with surveys of local real estate development and land use professionals and other stakeholders.
- < Develop a scenario for project alternatives based on findings from quantitative and qualitative analyses.

Resources and Supplementary Readings

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